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GILMOUR (D.). **The biochemistry of insects.**—9¼ × 6 in., xii + 343 pp., 1 pl., 46 figs., many refs. New York, N.Y. & London, Academic Press, 1961. Price £3 4*s*. or $8.00.

Biochemistry is usually treated in text-books as a unified subject with examples drawn from widely differing biological groups. This has led to emphasis on the chemistry of reactions rather than on the chemistry of organisms. In this book, which is the first of its kind, an attempt is made to reverse this trend and to cover the whole of existing knowledge of the biochemistry of a single group, namely, insects, which constitute the major part of the fauna of the world. The book consists of an introduction and three main sections, dealing, respectively, with energy metabolism, intermediate metabolism and the biochemistry of the development of insects.

MATHUR (R. N.). **Clump-curing of bamboos and susceptibility to powder-post beetle attack.**—*Indian For. Bull.* (N.S.) Ent. no. 221, 19 pp., 3 refs. Delhi, 1958.

In tests in 1949–50 at Dehra Dun, Uttar Pradesh, the curing of cut bamboos (*Dendrocalamus strictus*) in upright bundles in the forest had a negligible effect on their starch content, which varied with season, and did not protect them from attack by species of *Dinoderus*, mainly *D. ocellaris* Steph., and other borers.

DUTT (N.). **Two pests that bother mesta and roselle.**—*Indian Fmg* **9** no. 6 pp. 7–10, 6 figs. New Delhi, 1959.

Hibiscus cannabinus and *H. sabdariffa*, which are grown for fibre in north-eastern India, are severely infested by *Agrilus acutus* (Thnb.) and *Maconellicoccus* (*Phenacoccus*) *hirsutus* (Green), respectively. *A. acutus*, which was introduced into the country in 1950, lays its eggs on the stems, most frequently at the nodal region below the leaf base, and the larva makes a spiral tunnel beneath the bark round the woody tissues. As it becomes full-fed, it makes an elongated gall at the end of the tunnel, particularly on plants 6–8 ft. high and usually within 1·5 ft. of the base. The stems of attacked plants become weakened at this point and readily snap in a strong wind. Crops sown in April are the most susceptible to the pest, but control can be obtained by applying 2·5 per cent. methyl-demeton (Metasystox) in water by the swab method. *A. acutus* also infests *H. sabdariffa*, particularly after *H. cannabinus* has been harvested, but causes much less injury to it, no galls being formed.

The adult females of *M. hirsutus* complete oviposition in 5–8 days, laying their eggs in batches. The nymphs and adult females feed on the succulent apical portion of the stem, though in very young plants the petioles and blades of the apical leaves are also attacked; in a seed crop, the young capsules are infested and seed production reduced. Infested plants become stunted, owing to the arrest of the vertical growth of the internodes, which swell up and develop a deep green colour. If these conditions extend to the petioles, the plants take on a typical bushy appearance. When the attack is severe, the plants may die. In the field, the mealybug usually occurs in small patches. *H. cannabinus* is also attacked at times, but is much less susceptible than *H. sabdariffa*. For control, sprays of 1·5 per cent. nicotine sulphate or 0·02 per cent. parathion (Folidol) are recommended.

Outbreaks and new records.—*FAO Plant Prot. Bull.* **9** no. 1 p. 11. Rome, 1960.

It is reported from India by G. A. Gangrade that a Delphacid tentatively identified as *Chloriona* (*Sogata*) *furcifera* (Horv.), of which *S. pallescens* Dist. is a synonym, was found infesting rice in the Jabalpur district of Madhya Pradesh in September–October 1958. It spread to two other districts of the State in 1959 and appears to have become established as a major pest of rice in the area. The insects were prevalent on the crop from August to October, up to 20–25 nymphs and adults occurring per plant. Both stages were active in the morning and evening and hid under leaves in the hot afternoon. Feeding by them caused the plants to appear pale and stunted, and the tips of the leaves turned red if infestation was severe.

O'Connor (B. A.). **The coconut treehopper, *Sexava* spp., and its parasites in the Madang district.**—*Papua New Guinea agric. J.* **11** no. 4 pp. 121–125, 2 figs., 7 refs. Port Moresby, 1959.

As coconut is free from severe attack by Tettigoniids of the genus *Sexava* in the Madang district of New Guinea, but severely damaged on the islands to the east, attention was paid to possible control factors during an entomological survey of the area to the west of Madang. This report of the work was prepared in 1941, but publication was prevented by war conditions.

It was found that coconut was attacked by numerous Tettigoniids, including two unidentified species of *Sexava*, of which one was typical of the New Guinea coast and the other of the islands of Manam and Kar Kar, though it also occurred at Maprik; the second corresponded closely to a specimen originating from Indonesia. The characters of the two species are compared in a table. Both were attacked by a Strepsipterous parasite, the reproductive rate of which far surpassed that of any other known; a conservative estimate showed that one female contained 750,000 eggs and larvae. Little was known of the biology of the parasite, but it appeared to be parthenogenetic, no male puparia being found in some 500 parasitised hosts dissected. The adult females and triungulin larvae are described; the behaviour of the latter probably resembles that of *Corioxenos antestiae* Blair [*cf. R.A.E.*, A **26** 179], and the species may be identical with *Stichotrema dalla-torreanum* Hofeneder, which parasitises *Sexava nubila* (Stål) in the Schouten Islands and has also been recorded from the Admiralty Islands, though the record is doubtful. Emergence of the larvae, the only female stage that exists in the open, took place throughout the day and probably continued at night. The parasite attacked both older nymphs and adults, partly or wholly inhibiting egg production by host females, and probably also rendering the males sterile. The percentage parasitism was highest on Manam, where it averaged 60. The two species of *Sexava* were equally susceptible, and three other Tettigoniids were also attacked, though to only a minor degree.

It is stated in an introductory note that several hundred parasitised *Sexava* adults were taken to Manus in 1941 and liberated on coconut at three places. Nymphs and adults of *Sexava* collected in Manus were then placed in the cages that had been occupied by the parasitised individuals, and a high percentage of parasitism was obtained. Subsequent observations showed that the hosts that had been attacked as adults died before the next generation of triungulins emerged, death usually occurring about a week after the cephalothorax of the parasite could be seen protruding from the abdomen of the host. Egg production by host females was definitely inhibited. When the parasite attacked nymphs, its life-history appeared to be longer,

lasting some 50 days. Two of the liberation sites were inspected in 1945, but no sign of the parasite could be found.

It was later noted in a paper by R. M. Bohart that Strepsiptera of the family Myrmecolacidae that parasitise ants may be the males of species of *Stichotrema*. If this should be the case and a Myrmecolacid parasite were found in an ant species in areas such as Manam, where *Stichotrema* is established, it would appear that successful colonisation of the latter might depend on simultaneous introduction of the ant.

It is further stated in the paper that 5 per cent. of the adults and 10 per cent. of the sixth- and seventh-instar nymphs of *Sexava* on the Madang coast were parasitised by an unidentified Tachinid.

USHATINSKAYA (R. S.). **On the problem of regulating the diapause of the Colorado beetle** (*Leptinotarsa decemlineata* **Say**). [*In Russian.*]—*Dokl. Akad. Nauk SSSR* **129** no. 6 pp. 1445–1448, 1 graph, 4 refs. Moscow, 1959.

Adults of *Leptinotarsa decemlineata* (Say) preparing for winter diapause undergo physiological changes that increase their resistance to insecticides and other unfavourable environmental factors [*cf. R.A.E.*, A **49** 132]. In the experiments described, which were carried out in Berlin at 18–20°C. [64·4–68°F.], attempts were made to hasten or delay the onset of diapause by means of chemicals. Cut potato shoots standing in damp soil were treated with 0·1, 0·05, 0·01 and 0·001 per cent. solutions of five growth regulators, and beetles were confined with them and observed until the occurrence of diapause, as evidenced by entry into the soil. Control plants were treated with water only.

In eastern Germany, the summer adults feed for 18–25 days before entering diapause. Immediately after emergence, they are very sensitive to environment, and mortality is high during the first 3–5 days. In the tests, the control insects entered diapause after 11–37 days and mortality was considerable.

In the series treated with α-naphthylacetic acid, there was 40–60 per cent. mortality in the first five days, and the remaining beetles fed normally and entered diapause 5–8 days later than the controls. Survival was greatest at 0·05 per cent., at which the last insects entered diapause 19 days later than the controls. With monoiodoacetic acid, there was only 20–37 per cent. mortality in the first five days, and the survivors entered diapause at about the same time as the controls. With methylene blue at 0·1 per cent., all the beetles died in 11 days; at 0·05 per cent., mortality was 90 per cent. after 17 days and the survivors entered diapause after 17–23 days. At 0·01 per cent., the first beetles entered diapause at the normal time, but the last ones did so 10–15 days after the controls. At 0·001 per cent., active feeding occurred, which accelerated onset of diapause by 4–7 days. With vitamin K_3 (2-methyl-1,4-naphthoquinone), mortality was similar to that in the controls during the first five days and later did not exceed 20–22 per cent. Feeding was stimulated, and diapause occurred 3–8 days earlier than in the controls. Dimethyl-hydroxyethyl-stilboestrol was toxic at all concentrations, 53·4–61 per cent. mortality occurring in the first few days. The diapause occurred 15–25 days later than in the controls, and the period of feeding before it lasted 34–52 days; one beetle fed for 93 days on shoots treated at 0·05 per cent. and then died.

It is concluded that the diapause of *L. decemlineata* can be accelerated or retarded by chemicals, and that the use of metabolic stimulants with insecticides might increase the effectiveness of the latter.

Sazonova (G. V.). **Peculiarities in the behaviour of the noxious Pentatomid in the spring period in the Lower Volga region in connection with the possibility of using a bait method for its control.** [*In Russian.*]—*Zool. Zh.* **37** pt. 8 pp. 1143–1149, 1 graph, 13 refs. Moscow, 1958. (With a summary in English.)

In the Lower Volga region, *Eurygaster integriceps* Put. appears in grain fields in May and early June, but, because of the severe daily fluctuations in temperature, the bugs spend much of the time sheltering under weeds and plant débris, where pairing and oviposition take place. On warm sunny days, they leave their shelters at 10–11 a.m. and return to them at 3–4 p.m., but on cool overcast days, they remain in them throughout. The females are more susceptible to cold than the males. In experiments in 1955 and 1956 in the Saratov region, the bugs sheltered under small bundles of straw or boards placed in the fields in spring, and three times as many did so when the fields were previously cleared of weeds and débris. Such shelters can be used for purposes of control, and treatment with methyl-parathion (Wofatox) did not decrease their attractiveness [*cf. R.A.E.*, A **48** 346].

Gubar. Rezultati rada na njegovom proučavanju i suzbijanju kod nas u toku 1957 godine. [The gipsy moth. Results of the work on its study and control in the course of 1957.]—*Plant Prot.* no. 41–42, vi+155 [+2] pp., 14 pls., 15 graphs, 3 maps, many refs. Belgrade, 1958.

This symposium consists of an introduction by S. Živojinović, who points out that *Lymantria dispar* (L.) is the most important pest of forests and orchards in Yugoslavia and that extensive control operations were required in 1956–57 to stem the current outbreak, followed by 16 papers by different authors on various aspects of the bionomics and control of the moth. All have summaries in English.

K. Vasić & L. Janković (pp. 3–15) discuss fundamental and supplementary indicators, such as the number, size and distribution of the egg-masses and the behaviour of the larvae, that can be used to ascertain the stage reached by an outbreak and its future course. Vasić (pp. 17–21) reviews the parasites of the moth, of which *Apanteles* spp. are the most important. M. Maksimović (pp. 23–33) describes experiments showing that the winter diapause of the eggs of *L. dispar* cannot be terminated by exposure to low temperatures in autumn and that it is prolonged by a temperature of 5°C. [41°F.]. Janković (pp. 35–48) records detailed investigations in 1957 on the ecology of *L. dispar* at a forest centre in Serbia, particularly in relation to the distribution of the eggs and other stages and the seasonal course of development. Vasić & P. Sisojević (pp. 49–52) briefly review the parasites of the prepupae and pupae and their frequency in 1957. Vasić & Janković (pp. 53–56) describe preliminary observations on the effect on the forest fauna of aeroplane applications of DDT against *L. dispar*. L. Vasiljević (pp. 57–66) describes investigations showing that larval mortality due to polyhedral disease is favoured by high temperatures. E. Georgijević & V. Vaclav (pp. 67–74) summarise findings on the distribution of *L. dispar* in Bosnia-Herzegovina in 1957. Maksimović (pp. 75–79) describes preliminary experiments on the use of the sex attractant of the females for control purposes in forests, and Janković (pp. 81–87) compares the ecological characteristics of the moth at low and high altitudes. S. Todorović (pp. 89–105) reviews the work on control by insecticides that was carried out in 1957 in various parts of the country and states that excellent protection of fruit trees and valuable forest stands was given by drenching the

egg-masses with DNC preparations and by spraying with DDT from the air or ground against the larvae. Georgijević & Vaclav (pp. 107–122) describe observations on the causes of mortality of the moth in areas of Herzegovina where control measures were not undertaken and show that parasites and polyhedral disease were the most important, and Vasiljević (pp. 123–137) discusses the occurrence of this and other diseases of the moth in Serbia in 1957. Janković (pp. 139–142) summarises work on the ecology and population dynamics of *L. dispar* in a lowland forest reserve near Belgrade, and Maksimović (pp. 143–145) records work on the effect of abiotic factors of control, largely low temperatures, in another lowland habitat. Vasić & Janković (pp. 147–155) give the results of analyses of egg-masses collected in various parts of the country in 1957, from which it is concluded that the outbreak had reached its peak in Croatia and Macedonia and was declining in Serbia, Montenegro and Bosnia-Herzegovina.

Vasić (K.) & Petrović (M.). **Kvalitativna analiza uloge parazitskih insekata, i entomofagnih gljivica u redukciji prenamnoženih populacija obične borove zolje** (*Diprion pini* **L.), na Maljenu 1954 i 1955 godine.** [Qualitative analysis of the importance of insect parasites and entomophagous fungi in the control of the outbreak of *D. pini* in the Maljen in 1954 and 1955.]—*Plant Prot.* no. 43 (1957) pp. 3–28, 11 graphs, 12 refs. Belgrade [1958]. (With a summary in English.)

In the course of investigations in 1954–55 on the Maljen mountain, Serbia, on the natural enemies attacking *Diprion pini* (L.) on pines [*cf. R.A.E.*, A **45** 302], it was found that the egg-parasite, *Achrysocharella ruforum* (Krausse), was far the most important. Its distribution was uneven, and though the percentage of eggs parasitised reached 100 in some places, it was only 17 in others. Parasitism of the cocoons was about 70 per cent. at low altitudes and 27 at high ones. Of the 14 species of parasites reared from them, *Exenterus amictorius* (Panz.) (*marginatorius* (F.)), *Aptesis* (*Microcryptus*) *basizona* (Grav.) and *Agrothereutes* (*Spilocryptus*) *adustus* (Grav.) were the most important, with 10–13, 1·3–11·1 and 0·7–8·8 per cent. parasitism, respectively. The first was obtained mostly from cocoons gathered from the ground, and the other two mostly from those collected from the trees. The other cocoon parasites were sporadic, except for *Dahlbominus fuliginosus* (Nees) (*fuscipennis* (Zett.)), which was numerous on low ground. Cocoons of the first generation were little affected by entomogenous fungi, but the eonymphs in overwintering cocoons were severely attacked by unidentified species of *Verticillium* and *Cephalosporium*. The eggs were infested by *Sclerophoma* sp., especially in spring. Insect predators were of no practical importance, but many larvae were killed by a virus disease in autumn.

Lazarević (B.). **Jabukin svrdlaš.** [*Rhynchites bacchus* L.]—*Plant Prot.* no. 43 (1957) pp. 29–53, 7 figs., 1 graph, 11 refs. Belgrade [1958]. (With a summary in English.)

Rhynchites bacchus (L.) is widely distributed in Serbia as a pest of apples, pears and stone fruits and occasionally causes 100 per cent. loss of crop. All stages of the weevil are described, and an account is given of investigations on its bionomics carried out in 1954–56. The adults appeared in April and fed at first on the flower and leaf buds. Pairing began in May, and eggs were laid in the young fruits, which were also pierced for feeding. In puncturing the fruits, the weevils invariably infected them with *Monilia* sp.,

which caused mummification. The maximum number of eggs laid by one female was 431, and the average 225; fecundity depended on the food and on the frequency of pairing. Most eggs were laid by females feeding on apple fruits, followed by those feeding on cherries, and the fewest were laid by females feeding on leaves. The climax of oviposition occurred at the end of May and the beginning of June. The larvae hatched in 10–12 days in the field and in 4–6 days in the laboratory at 26°C. [78·8°F.] and fed in the fruits. When fully fed, they left the trees and entered the soil. Those that did so by the end of August pupated and gave rise after 22 days to adults that hibernated in the pupal chambers, whereas the majority, which left the fruits later, overwintered in the soil in diapause and did not give rise to adults until the second half of the following summer; these adults fed until cold weather and then overwintered beneath fallen leaves or bark. The eggs and larvae were attacked by numerous parasites. In laboratory tests with emulsion sprays, 0·02 per cent. lindane [almost pure γ BHC], 0·25 per cent. DDT or 0·02 per cent. parathion gave up to 100 per cent. mortality of the adults. Spraying the trees in early spring before or immediately after flowering is recommended.

Böhm (H.). **Ergebnisse mehrjähriger Versuche zur Bekämpfung des Apfelwicklers,** *Carpocapsa pomonella* **L.** [The results of several years' experiments on the control of *Cydia pomonella*.]—*Pflanzenarzt* **12** no. 5 pp. 51–53. Vienna, 1959.

Sprays are applied each year against *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple in Austria, and the results obtained near Vienna in 1950–58 are shown in a table and discussed. In this area, the moth has a prolonged flight and oviposition period in spring, and only insecticides that provide long-lasting deposits afford protection. The best results were therefore given by spraying with lead arsenate against the first generation and calcium arsenate against the second. DDT was the next best, and parathion, diazinon and trichlorphon (Dipterex) were not very satisfactory.

Böhm (H.). **Fruchtstecher, Gelegenheitsschädlinge im Obstbau.** [Occasional pests that puncture fruits in orchards.]—*Pflanzenarzt* **12** no. 5 pp. 54–56, 5 figs. Vienna, 1959.

Pip and stone fruit trees in Austria have in recent years been damaged by various weevils that puncture the fruits and other tender plant parts early in the year in the course of maturation feeding and oviposition after hibernation. The species concerned are *Rhynchites aequatus* (L.) on apple and other pip fruits, *R. cupreus* (L.) and *Anthonomus rectirostris* (L.) on stone fruits, and *R. bacchus* (L.) and *R. auratus* (Scop.) on both, and a table is given showing their characters and duration of development, the fruits concerned and the type of damage and the site of development of the larvae.

Russ (K.). **Die Bekämpfung der Blattgallenreblaus mit verschiedenen Winterspritzmitteln.** [Control of the leaf form of *Phylloxera vitifoliae* with various winter spray preparations.]—*Pflanzenarzt* **12** no. 10 p. 106 Vienna, 1959.

In tests on the control of the leaf form of *Phylloxera vitifoliae* (Fitch) in Austria, the vines were sprayed with various proprietary preparations during

the late dormant stage on 24th March 1959. Observations on 25th June showed that a spray containing tar distillate combined with mineral oil was as effective as DNC, both giving 94·8 per cent. control, and dinoseb almost as good.

Böhm (H.). **Die Mittelmeerfruchtfliege im Jahre 1959.** [The Mediterranean fruit-fly in 1959.]—*Pflanzenarzt* **13** no. 1 pp. 3, 4, 2 maps. Vienna, 1960.

As a result of the cold winter of 1955–56, *Ceratitis capitata* (Wied.) was not numerous near Vienna in 1956 or 1957 [*cf. R.A.E.*, A **48** 550], but a considerable increase occurred in 1958 and again in 1959, when the infested area was greatly enlarged. The principal host fruits in the district are morello cherries and peaches, and these were very heavily infested.

Russ (K.). **Ein Schritt weiter in der Springwurmbekämpfung.** [A step forward in the control of *Sparganothis pilleriana*.]—*Pflanzenarzt* **13** no. 2 pp. 13–14, 3 figs. Vienna, 1960.

Sparganothis pilleriana (Schiff.) has recently caused increased injury to vines in Austria, and experiments on its control were begun in 1957. The larvae hatch in July, overwinter on the stocks without feeding, and attack the buds and leaves in spring, but the period over which they leave their winter quarters lasts 2–3 weeks and extends from late April to the middle of May. The adults emerge at the end of July, and the eggs laid by them hatch a fortnight later. In tests against the newly hatched larvae in July 1958, various DDT sprays gave insufficient control. A dormant treatment with parathion in oil emulsion (oleoparathion) applied on 24th March 1959 gave 92 per cent. control and was much superior to DNC, and several materials, including parathion, trichlorphon (Dipterex) and DDT, gave 90 per cent. or more control in summer sprays applied in mid-May; methyl-demeton (Metasystox) was ineffective.

Faber (W.). **Zwei Gelegenheitsschädlinge an Getreide.** [Two occasional pests of cereals.]—*Pflanzenarzt* **13** no. 11 pp. 107–109, 4 figs. Vienna, 1960.

Abnormal weather in Austria in 1960 led to unusually great damage to wheat by the sawfly, *Dolerus gonagra* (F.), and to rye by *Phytomyza nigra* Mg. The habits of these insects and the damage that they caused to the leaves are described.

Böhm (H.). **Zum Massenauftreten der Obstbaum-Miniermotte,** *Lyonetia clerkella*. [A mass occurrence of *L. clerkella*, the fruit-tree leaf-miner.] —*Pflanzenarzt* **13** no. 12 pp. 116–117, 4 figs. Vienna, 1960.

Damage to the leaves of apple and cherry, and to a less extent of pear and damson, by *Lyonetia clerkella* (L.) caused concern in Austria in 1960, when an outbreak of this leaf-miner appeared to be in progress. The appearance and habits of the moth, which has two, or under favourable conditions three, generations a year, are described. In tests on control, parathion sprays gave the best results.

Richter (B.). **Zur Bekämpfung des Schattenwicklers** (*Cnephasia wahlbomiana* **L.) an Erdbeeren.** [The control of *C. virgaureana* on strawberry.]—*Pflanzenschutz* **11** no. 3 pp. 48–50, 8 refs. Munich, 1959.

Cnephasia virgaureana (Treitschke) (*wahlbomiana*, auct.) has been increasing in southern Germany of recent years [*cf. R.A.E.*, A **49** 207] and has attacked numerous crops, including strawberries, on which the overwintered larvae injure not only the leaves but also the flower buds. In tests on their control in 1958, the best results were given by spraying with 0·05 per cent. parathion; lindane [γ BHC] and Hostatox [polychloroendomethylenetetrahydroindene] protected the buds but not the leaves, which were more heavily infested. Thiodan was fairly effective. Since the larvae are protected in the feeding sites by webbing, treatment should be applied early, when migration to the plants is only just beginning.

Bollow (H.). **Über ein diesjähriges Auftreten der Brachfliege** (*Phorbia coarctata* **Fall.) in Bayern.** [An outbreak this year of *Hylemyia coarctata* in Bavaria.]—*Pflanzenschutz* **12** no. 10 pp. 139–142, 4 figs. Munich, 1960.

Hylemyia (*Phorbia*) *coarctata* (Fall.), which is usually of little importance on wheat in Bavaria, was unusually numerous in 1960. The damage caused is similar to that due to *Oscinella frit* (L.). The habits of these two flies are described, their distribution in Bavaria in 1960 is illustrated on maps, and their characters and bionomics are compared in a table. Measures for the control of *H. coarctata* are reviewed.

Bollow (H.). **Die Blattsauger** (*Psylla*) **der Apfel- und Birnbäume. Auftreten, Aussehen, Lebensweise, Voraussage und Bekämpfung.** [The Psyllids of apple and pear trees. Occurrence, appearance, life-history, prognosis and control.]—*Pflanzenschutz* **12** no. 11–12 pp. 159–166. 4 figs., 2 maps. Munich, 1960.

Attack on apple and pear by *Psylla* spp. was severe in Bavaria in 1960. The species concerned were *P. mali* (Schmidb.) and *P. costalis* Flor on apple, and *P. pyri* (L.), *P. pyricola* Först., *P. pyrisuga* Först. and *P. melanoneura* Först. on pear, and their characters, bionomics and control are reviewed. The abundance of *P. mali* can be forecast from counts of overwintering eggs. The others overwinter as adults on and off the trees, and forecasting is thus more difficult.

Pag (H.). *Hyponomeuta*-**Arten als Schädlinge im Obstbau. Ein Beitrag zur Biologie, Ökologie und Bekämpfung, unter besonderer Berücksichtigung des Arten- und Rassenproblems.** [*Hyponomeuta* spp. as pests in fruit-tree cultivation. A contribution to their bionomics, ecology and control, with special reference to the problem of species and races.]—*Z. angew. Zool.* **46** pt. 2 pp. 129–189, 14 figs., 114 refs. Berlin, 1959. (With a summary in English.)

Of the moths of the genus *Hyponomeuta* that infest fruit trees in Germany, the most important are *H. padellus* (L.), which attacks plum, hawthorn (*Crataegus oxyacantha*) and blackthorn (*Prunus spinosa*), and *H. padellus malinellus* Zell., which infests apple and is treated by the author as a distinct species [*cf. R.A.E.*, A **32** 157–158, etc.]. In addition, *H. cuonymellus* (L.), of which the principal food-plant is bird cherry (*Prunus padus*), sometimes attacks cultivated cherries, and *H. cognatellus* (Hb.), of which the main

food-plant is *Euonymus*, occasionally infests fruit trees, but these last two are of little economic importance. The literature on the bionomics, food-plants and injuriousness of the various species is reviewed, and investigations carried out near Berlin are described.

The overwintered larvae of *H. padellus malinellus* left the shields covering the eggs and began feeding at the end of April in 1956 (at a temperature of 15–18°C. [59–64·4°F.]) and at the beginning of April in 1957 (temperature 15–21°C. [59–69·8°F.]). They mined the leaves for about a fortnight and then fed on their upper surfaces, webbing the leaves together. Pupation occurred after about seven weeks, and adults were present from late June or early July to about mid-September. The others had similar life-histories, and it is noted that typical *padellus* also mines the leaves in the first instar. The view that *H. padellus* consists of various races, of which *malinellus* is one, each with a distinct food-plant preference [*cf. loc. cit.*], is discussed. Tests with material from many parts of Germany showed that whereas *H. p. malinellus* always preferred the leaves of apple to those of plum, blackthorn or hawthorn for both feeding and oviposition, *H. padellus* from any of these three showed no outstanding preference for any one of them and also accepted apple; there was some indication of a slight preference of the latter for ovipositing on hawthorn in all cases. Comparison of male genitalia showed slight differences in the shape of the valves between individuals of *H. p. malinellus* from apple and those of *H. padellus* from plum, hawthorn and blackthorn, and there were also differences in the pupae and in the colour of the wings. The author concludes that no separation of *H. padellus* from these three plants into races has as yet occurred in Germany, but that there is sufficient evidence to support the view that *H. p. malinellus* is a distinct species. Feeding and oviposition tests confirmed that although *H. cognatellus* and *H. euonymellus* preferred *Euonymus* and *P. padus*, respectively, to various fruit trees, cherry was readily attacked by the latter (although no instance of this was observed in the field near Berlin).

The occurrence of damage to fruit trees by *Hyponomeuta* in Germany since 1925 is reviewed, and its distribution is shown on a map. The most serious damage occurred in the north-west and Saxony. Investigations on the importance of temperature and humidity on development [*cf.* **30** 248] indicated that a cold winter, followed by gradually increasing temperatures, does not appreciably harm the young larvae, but that widely varying temperatures following a short mild winter are injurious. The duration of the pupal stage of *H. p. malinellus* varied considerably in the laboratory, ranging (at 70–80 per cent. relative humidity) from 6–7 days at 30°C. [86°F.] to 8–20 days at 10°C. [50°F.], and there was a similar range in the case of typical *H. padellus*. Parasites reared from the various species are listed, and the possibilities of biological control are discussed. Small-scale laboratory and field tests showed that complete control of the overwintering larvae was given by aqueous sprays of DNC in combination with oil or tar distillate, which assisted penetration beneath the egg-shields, but not by DNC or tar distillate alone. Fourth- and fifth-instar larvae were susceptible to several insecticides, and sprays of malathion and trichlorphon (Dipterex) remained effective against them for 8 and 11 days, respectively.

GÄBELE (M.). **Beiträge zur Kenntnis der Gattung** *Bryobia* **(Acari, Tetranychidae).** [Contributions to knowledge of the genus *Bryobia*.]—*Z. angew. Zool.* **46** pt. 2 pp. 191–247, 11 figs., 59 refs. Berlin, 1959. (With a summary in English.)

The author reviews attempts made in recent years to subdivide the complex of *Bryobia praetiosa* Koch [*cf. R.A.E.*, A **47** 117, 118, etc.] and records

investigations on the morphology and bionomics of these mites near Stuttgart. Three species were observed, *B. kissophila* van Eyndhoven on ivy [*Hedera helix*], *B. rubrioculus* (Scheuten) on fruit trees (especially apple and pear) and one referred to as *B. graminum* (Schr.), which occurred as two subspecies, one (*B. graminum*) having several generations a year and infesting grasses and sometimes apple and pear, and the other, for which the name *B. graminum graminum* is used, having one generation a year and feeding on grasses only. No males were observed. The morphology of the four forms is described in detail and characters distinguishing the three species in the larval and nymphal stages and all four forms in the adult are described and set out in a key. The only difference between *B. graminum* and *B. graminum graminum* lies in the size of the adult, that of the latter being slightly larger.

Investigations on the bionomics of the mites were carried out in outdoor conditions in 1954–56, and the following is taken almost entirely from the author's summary of the results. *B. rubrioculus* (which was studied on apple) overwintered in the egg stage on twigs, and the nymphs hatched in the second half of April. There were three overlapping generations a year, and the mites were restricted to the crowns of the trees. Summer eggs were laid on both twigs and leaves, the numbers averaging 25–30 per female. Cherry and damson were infested, in addition to apple and pear. The bionomics of *B. graminum* and *B. graminum graminum* were similar in many respects to those of the grass forms of Venables and Mathys [**31** 364; **44** 320]. *B. graminum* overwintered in all stages but more usually in the egg, and hatching occurred in late March, about a month earlier than in *B. rubrioculus*. Oviposition took place on the lower parts of the trunks of apple or pear (particularly the former, owing to the presence of lichens) or on walls and fences near these trees. The adults laid 30–35 eggs each on average, and there were seven generations a year. In spring, the mites fed on grasses near the base of the trees, and later, from mid-July until mid-September, they ascended the trees and fed on leaves in the crowns (mainly on apple); moulting and oviposition took place at all times on the lower trunk or other places of origin. The non-overwintering generations developed in about 27–57 days, and the adults lived for 18–103 days. *B. graminum graminum* overwintered in the egg stage on the lower parts of the trunks of apple or pear. The larvae hatched in about the second half of January, but development, which required 76–92 days to the adult stage, began only at the beginning of March, owing to cold weather. The mites fed on grasses and weeds near the base of the trees, laid about 45 eggs each on average and died by mid-June; moulting occurred on the trunks.

In tests on food-plant range, in which the mites were transferred to various fruit trees, gooseberry, ivy and grasses, *B. rubrioculus* developed only on fruit trees, *B. kissophila* only on ivy, *B. graminum* only on fruit trees and grasses, and *B. graminum graminum* only on grasses.

Huger (A.). **Untersuchungen zur Pathologie einer Mikrosporidiose von *Agrotis segetum* (Schiff.) (Lepidopt., Noctuidae), verursacht durch *Nosema perezioides* nov. spec.** [Investigations on the pathology of a microsporidiosis of *A. segetum*, caused by *N. perezioides*, sp.n.]—*Z. PflKrankh.* **67** pt. 2 pp. 65–77, 19 figs., 16 refs. Stuttgart, 1960. (With a summary in English.)

Larvae in a laboratory colony of *Agrotis segetum* (Schiff.) in Germany were found to be infected with Microsporidia for which the name *Nosema perezioides*, sp.n., is here proposed. Infected larvae ceased to feed, but

frequently moulted to the next instar before dying. The histopathological symptoms caused, the reactions of the cells to infection, and the spores are described. Infection was induced by feeding, and young larvae were more susceptible than older ones.

Stein (W.). **Untersuchungen über die Möglichkeit einer Bekämpfung von Raubmilben in Zuchten der Getreidemotte** (*Sitotroga cerealella* [Oliv.]) **durch Anwendung von Akariziden.** [Investigations on the possibility of controlling predacious mites in cultures of *S. cerealella* by the use of acaricides.]—*Z. PflKrankh.* **67** pt. 2 pp. 77–87, 5 graphs, 12 refs. Stuttgart, 1960. (With a summary in English.)

The following is based on the author's summary. In tests in Germany on the control of predacious mites of the genera *Blattisocius* and *Cheyletus* in cultures of *Sitotroga cerealella* (Ol.), deposits of chlorobenzilate and Kelthane applied at dilutions of 0·1 and 0·2 per cent., respectively, to the interior of glass tubes killed the larvae of the mites confined on them, but 0·2 per cent. Tedion was ineffective. None of these materials affected the adults. All were toxic to first-instar larvae of *S. cerealella*, but none except Kelthane affected later stages of the moth, and none affected parasitism of the eggs by *Trichogramma* females. The use of chlorobenzilate in infested *Sitotroga* cultures is described.

Buhl (C.). **Untersuchungen über die Wirkung hochprozentiger Lindansaatgutpuder zur Bekämpfung des Rapserdflohes** (*Psylliodes chrysocephala* **L.) und des Kohlgallenrüsslers** (*Ceuthorrhynchus pleurostigma* **Mrsh.).** [Investigations on the effect of high-percentage lindane powders for seed treatment against *P. chrysocephala* and *C. pleurostigma.*]—*Z. PflKrankh.* **67** pt. 6 pp. 321–326, 3 refs. Stuttgart, 1960. (With a summary in English.)

Details are given of experiments in north-western Germany in which seed treatment with a powder containing 75–80 per cent. γ BHC (lindane) at 5 per cent. by weight of the seed, with an adhesive, afforded excellent protection of winter rape against larvae of *Psylliodes chrysocephala* (L.) attacking the seedlings, even in December. The treatment also prevented attack by *Ceutorhynchus pleurostigma* (Marsham), but had no effect on *Phytomyza rufipes* Mg. mining the petioles.

Bonnefoi (A.) & Béguin (S.). **Recherches sur l'action des cristaux de** *Bacillus thuringiensis* **Berliner souche "Anduze".**—*Entomophaga* **4** no. 3 pp. 193–199, 16 refs. Paris, 1959. (With a summary in English.)

The following is based on the authors' summary. Research on the pathogenic effects of *Bacillus thuringiensis* on insects is reviewed with special reference to the toxicity of the crystals that appear during sporulation, and experiments with the Anduze strain of the bacillus are described, showing that pure extracts of the crystals were 2·5 times as effective as a standard spore preparation. It is concluded that the crystals are responsible for mortality in larvae of which the pH of the intestine is greater than 9, as in most Lepidoptera.

Burgerjon (A.). **Titrage et définition d'une unité biologique pour les préparations de** *Bacillus thuringiensis* **Berliner.**—*Entomophaga* **4** no. 3 pp. 201–206, 1 graph, 9 refs. Paris, 1959. (With a summary in English.)

A method is described for the bioassay of preparations of *Bacillus thuringiensis*, using larvae of *Picris brassicae* (L.) approaching the fourth moult as the test insects, and for their titration in terms of ' biological units '. The value in biological units per mg. of a test sample is the inverse of the LC50, expressed as a fraction by weight, multiplied by the ratio of the correct to the experimental LC50 of a standard material.

Burgerjon (A.) & Grison (P.). **Sensibilité de différents lépidoptères à la souche " Anduze " de** *Bacillus thuringiensis* **Berliner.**—*Entomophaga* **4** no. 3 pp. 207–209, 1 ref. Paris, 1959. (With a summary in English.)

A list of 24 species of Lepidoptera is given, showing their susceptibility to the Anduze strain of *Bacillus thuringiensis*, as determined in laboratory tests.

Martouret (D.). **Applications diverses et normes d'utilisation de** *Bacillus thuringiensis* **Berliner, souche " Anduze ".**—*Entomophaga* **4** no. 3 pp. 211–220, 2 figs., 9 refs. Paris, 1959. (With a summary in German.)

An account is given of tests in France in which a preparation of the Anduze strain of *Bacillus thuringiensis* titrating 900 biological units per mg. [*cf.* preceding abstract but one] was used in sprays and dusts against *Picris brassicae* (L.) on cabbage. It was found that for good results sprays containing 1 lb. of the powder per 100 gal. should be applied at 126 gal. per acre and dusts containing 5 per cent. of the powder at 27 lb. per acre. The effectiveness of the treatments was reduced by rain. The powder was compatible with fungicides, and also gave good results against several other insects. It was harmless to honey bees.

van Damme (E. N. G.) & van der Laan (P. A.). **Some observations on the effect of E-58 powder (***Bacillus thuringiensis* **Berliner) on** *Malacosoma neustria* **L. (Lepid.).**—*Entomophaga* **4** no. 3 pp. 221–225, 4 graphs. 4 refs. Paris, 1959. (With a summary in German.)

Elms in Amsterdam are defoliated in spring and early summer by larvae of *Malacosoma neustria* (L.). Derris dusts are used for control, but give poor results against the older larvae. Since insecticides toxic to man and domestic animals are dangerous when used in a city, a spray containing a preparation of *Bacillus thuringiensis* was tested on a small scale. It proved fairly effective as a stomach insecticide and is considered worth further investigation.

Bonnefoi (A.) & Toucas (M.). **Essais de thermorésistance de l'organisme responsable de la maladie laiteuse de la larve du hanneton (***Melolontha melolontha***).**—*Entomophaga* **4** no. 3 pp. 227–231, 3 figs., 2 refs. Paris, 1959. (With a summary in English.)

Tests with the bacillus that causes a milky disease in larvae of *Melolontha melolontha* (L.) in France similar to that caused by *Bacillus popilliae* in

larvae of *Popillia japonica* Newm. in the United States [*cf. R.A.E.*, A **49** 93, etc.] showed that it retained its infectivity when infected haemolymph was diluted in distilled water and heated for one hour at 84°C. [183·2°F.], though its virulence was reduced. For elimination of concomitant saprophytic organisms from the haemolymph, a temperature of 75°C. [167°F.] is preferable.

Martouret (D.) & Dusaussoy (G.). **Multiplication et extraction des corps d'inclusion de la virose intestinale de** *Thaumetopoea pityocampa* **Schiff.**—*Entomophaga* **4** no. 3 pp. 253–259, 3 refs. Paris, 1959. (With a summary in German.)

Smithiavirus pityocampae, an intestinal cytoplasmic virus of *Thaumetopoea pityocampa* (Schiff.), was used in France for the control of that Notodontid on pine [*cf. R.A.E.*, A **49** 147]. In this paper, details are given of the method by which a sufficient number of polyhedra was obtained for the work from special colonies of infected larvae.

Arthur (A. P.) & Wylie (H. G.). **Effects of host size on sex ratio, development time and size of** *Pimpla turionellae* **(L.) (Hymenoptera: Ichneumonidae).**—*Entomophaga* **4** no. 4 pp. 297–301, 7 refs. Paris, 1959. (With a summary in German.)

An account is given of investigations in Canada showing not only that the size of the adults of *Pimpla turionellae* (L.) varies with that of the hosts in which the parasites develop, but also that their sex ratio does so likewise. Only males developed in small hosts such as *Anagasta kühniella* (Zell.), males and females developed in equal numbers in medium-sized hosts such as *Ostrinia (Pyrausta) nubilalis* (Hb.), *Galleria mellonella* (L.), *Pieris rapae* (L.) and *Trichoplusia ni* (Hb.), and fewer males than females developed in large hosts such as *Malacosoma americanum* (F.). Development lasted much longer in large hosts than in small ones.

Mackauer (M.). *Trioxys similis* **n. sp. (Hym. Braconidae, Aphidiinae), eine neue Blattlaus-Schlupfwespe aus Frankreich. Nebst einigen biocönologischen und nomenklatorischen Bemerkungen.** [*T. similis*, sp.n., a new aphid parasite from France. Together with biocoenological and nomenclatorial remarks.]—*Entomophaga* **4** no. 4 pp. 303–309, 3 figs., 12 refs. Paris, 1959. (With a summary in English.)

Trioxys similis, sp.n., is described from adults of both sexes reared from peach aphids, presumably *Myzus persicae* (Sulz.), in France; it is also recorded from Serbia (Yugoslavia).

David (W. A. L.) & Gardiner (B. O. C.). **A** *Pieris brassicae* **(Linnaeus) culture resistant to a granulosis.**—*J. Insect Path.* **2** no. 2 pp. 106–114, 6 refs. New York, N.Y., 1960.

The following is based on the authors' summary. An account is given of experiments carried out to determine whether the larvae of a population of *Pieris brassicae* (L.) that had been maintained in the laboratory for nine years and had survived a severe attack of granulosis virus disease were

resistant to the disease, in comparison with stocks established with wild insects. All the results obtained supported the conclusion that the apparently healthy larvae of the old culture were resistant [*cf. R.A.E.*, A **48** 361], and they carried the virus in a form that could cause a severe epizootic among the larvae of a newly established culture.

Steinhaus (E. A.) & Marsh (G. A.). **Granulosis of the granulate cutworm.** —*J. Insect Path.* **2** no. 2 pp. 115–117, 1 fig., 2 refs. New York, N.Y., 1960.

During the autumn of 1959, an outbreak of disease caused by a granulosis virus occurred among larvae of *Feltia* (*Agrotis*) *subterranea* (F.) in northern California. The symptoms and the virus particles are briefly described.

Krywienczyk (J.) & Bergold (G. H.). **Serological relationships between insect viruses and their inclusion-body proteins.**—*J. Insect Path.* **2** no. 2 pp. 118–123, 10 refs. New York, N.Y., 1960.

The following is virtually the authors' summary. Several viruses of insects and their inclusion-body proteins were tested with heterologous antisera in complement-fixation tests. When Lepidopterous polyhedrosis virus antisera were used against polyhedron inclusion-body proteins, weak cross reactions occurred. Granulosis virus antisera gave only weak reactions, if any, with their inclusion-body proteins and no reaction with the polyhedron proteins. The inclusion-body protein antisera, tested against the viruses, gave less numerous but stronger cross reactions. The antisera against Hymenopterous polyhedrosis virus and inclusion-body protein gave no cross reaction with either type of antigen.

Menn (J. J.). **Bioassay of a microbial insecticide containing spores of *Bacillus thuringiensis* Berliner.**—*J. Insect Path.* **2** no. 2 pp. 134–138, 1 graph, 5 refs. New York, N.Y., 1960.

A rapid and simple bioassay method for the evaluation of insecticides prepared from the spores of *Bacillus thuringiensis* is described. Larvae of *Plutella maculipennis* (Curt.) are used as the test insects [*cf. R.A.E.*, A **49** 224].

McEwen (F. L.), Glass (E. H.), Davis (A. C.) & Splittstoesser (C. M.). **Field tests with *Bacillus thuringiensis* Berliner for control of four Lepidopterous pests.**—*J. Insect Path.* **2** no. 2 pp. 152–164, 12 refs. New York, N.Y., 1960.

In field tests in New York State in 1959, commercial preparations of *Bacillus thuringiensis* applied in sprays gave as good control of *Pieris rapae* (L.) and *Trichoplusia ni* (Hb.) on broccoli and *Argyrotaenia velutinana* (Wlk.) on apple as did conventional insecticides, though the last two insects required high dosages, but were inadequate against *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple. Treatments in which various insecticides and fungicides were combined with the bacillus indicated no serious deleterious effects, provided that the mixtures were not allowed to stand for long before application.

Neilson (M. M.) & Elgee (D. E.). **The effect of storage on the virulence of a polyhedrosis virus.**—*J. Insect Path.* **2** no. 2 pp. 165–171, 2 graphs, 8 refs. New York, N.Y., 1960.

The following is based on the authors' summary. Laboratory experiments with virus polyhedra from *Gilpinia* (*Diprion*) *hercyniae* (Htg.) in Canada showed that virulence is lost during storage. The loss is gradual, and complete inactivation is reached in 12 years. The relations between mortality of larvae and the period from infection to death for material 0–12 years old are discussed.

Bucher (G. E.). **Potential bacterial pathogens of insects and their characteristics.**—*J. Insect Path.* **2** no. 2 pp. 172–195, 43 refs. New York, N.Y., 1960.

The following is the author's summary. A classification is proposed to group the bacterial pathogens of insects with common fundamental properties or requirements. The name ' potential pathogens ' is proposed to indicate bacteria that multiply in the haemocoele from small inocula and produce a fatal septicaemia, but that are not actively invasive and do not multiply significantly in the gut of insects. These bacteria have a number of common characteristics of which two may be important in explaining their pathogenic behaviour: they produce strong proteolytic enzymes that may be responsible for degenerative changes in the phagocytic cells of the host and for the digestion of the host tissues, and they are aerobes capable of multiplying in the aerobic blood of insects but inhibited from multiplying in the relatively anaerobic gut. Inability to multiply in the gut prevents both the formation of large populations and the production of enzymes, and thus limits their ability to invade the haemocoele. Therefore transmission is limited and these potential pathogens do not produce epizootics in nature and cannot be utilised at present to control insect pests.

Smith (O. E.) & York (G. T.). **Moths of the European corn borer infected with the fungus** *Beauveria bassiana* **(Balsamo) Vuillemin.**—*J. Insect Path.* **2** no. 2 pp. 196–197, 1 fig. New York, N.Y., 1960.

Tests are described showing that *Beauveria bassiana* will infest adults of *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.).

Steinkraus (K. H.). **Studies on the milky disease organisms. I. Parasitic growth and sporulation of** *Bacillus popilliae*.—*J. Bact.* **74** no. 5 pp. 621–624, 4 figs., 7 refs. Baltimore, Md., 1957. **II. Saprophytic growth of** *Bacillus popilliae*.—*T.c.* pp. 625–632, 1 fig., 10 refs.

Steinkraus (K. H.) & Provvidenti (M. L.). **III. Variability among strains of** *Bacillus popilliae* **sporulating on artificial media.**—*Op. cit.* **75** no. 1 pp. 38–42, 1 fig., 5 refs. 1958.

The investigations described in these three parts of a series were carried out because of the desirability of developing a practical method for the large-scale production of spores of *Bacillus popilliae* for use against the larvae of *Popillia japonica* Newm. and *Amphimallon majalis* (Razoum.) in the United States.

In the work described in the first of them, the parasitic life-cycle of *B. popilliae* was re-examined in larvae of *A. majalis*, and it was found that most strains derived directly from diseased larvae were capable of parasitising healthy larvae and producing a typical milky disease in them. In the course of doing so, the bacteria completed a cycle of vegetative growth with formation of spores morphologically unique because of their parasporal bodies. Even when the bacteria became very numerous in the haemolymph, they did not cause an appreciable change in pH. As regards the oxidation-reduction potential of the haemolymph, both vegetative cell multiplication and sporulation occurred in a range of Eh from +240 to +450 mv. Morphological variations among spores of *B. popilliae* within a strain or among related milky-disease bacilli are noted.

The following is virtually the author's summary of the second part, in which saprophytic growth is discussed. While living larvae of *A. majalis* permitted multiplication of vegetative cells and sporulation of *B. popilliae* within their blood, dead macerated larvae sterilised by heat or extracts sterilised by filtration supported growth only in the vegetative-cell stages. No typical spores were formed. As a foundation for duplicating the parasitic life-cycle of *B. popilliae* on artificial media, a study was made of the growth requirements of various strains of this species. New media and conditions for growth of *B. popilliae* were devised. These maintained vegetative cells of many but not all strains of the species in their typical parasitic morphology. No typical spores formed, however, in the undisturbed cells. The surface of solid media was found to be superior to liquid media for culturing organisms. The organisms appeared preferably aerobic. Glucose, fructose, mannose, maltose, galactose and salicin were utilised. Sucrose, although not fermented by vegetative cells isolated on artificial media, stimulated germination and growth from spore inocula. Tryptone and yeast extract satisfied at least the minimal vegetative growth requirements of the organisms for complex organic molecules and growth factors. A characteristic type of twirling motility was noted in vegetative cells of *B. popilliae* after several transfers on artificial media.

The following is virtually the authors' summary of the third part. Numerous strains of *B. popilliae* were studied for ability to complete their parasitic life-cycles of growth and sporulation on artificial media. In addition to the typical spores consisting of a spore proper and a refractile parasporal body produced by some strains, two other spore types were formed by certain strains of *B. popilliae* on artificial media. One type was similar to the spore proper of parasitic spores, but lacked the parasporal body. It was formed on the growth media by a few strains that appeared to become adapted to saprophytic growth. These spores were of low virulence. The second type of atypical spore was ' abortive ' in the sense that it did not become refractile or heat resistant. The ' abortive ' spores were formed by abnormally large vegetative cells on the growth medium. Of the hundreds of spore suspensions of *B. popilliae* removed from diseased larvae of *A. majalis* and cultured on artificial media, only a very small percentage consistently formed typical parasitic spores under saprophytic conditions. The best strain so far examined failed to produce new parasitic-type spores for more than four complete life-cycles on artificial media. Generally, the ability to form typical spores was lost after the second transfer. The vegetative cells of these strains formed spores when injected into the living larval host, even after 100 transfers on artificial media. Typical spores did not form in cells left undisturbed on the medium on which they had grown. In order to reproduce the parasitic life-cycle on artificial media, it was necessary to grow the vegetative cells on a nutritionally sufficient medium and to collect the cells into a paste after growth was completed. Sporulation was facilitated by

transfer of this paste of vegetative cells to a starvation medium and by raising the incubation temperature. Strains forming spores of parasitic morphology on artificial media varied from trial to trial in ability to sporulate. Sporulation on artificial media was not stimulated by addition of larval extracts to the growth or sporulation media. Some strains grown in the vegetative state on artificial media had an enhanced pathogenicity which interfered with their ability to be parasitic when injected or fed to the living larvae.

Thomas (J. B.). **Mortality of white spruce in the Lake Nipigon region of Ontario.**—*For. Chron.* **34** no. 4 pp. 393–404, 2 figs., 10 refs. Toronto, 1958.

Most of the white spruce trees (*Picea glauca*) in the Lake Nipigon region of Ontario were severely defoliated by *Choristoneura fumiferana* (Clem.) for several years before 1948, and many were killed. The survivors appeared to refoliate satisfactorily in the years immediately after the decline of the outbreak, but dying trees became noticeable again by 1951, and investigations in 1951–55 showed that they had been attacked by bark borers, mainly *Dendroctonus piceaperda* Hopk. and *Ips perturbatus* (Eichh.), which appeared to be the immediate cause of death. Both these Scolytids are normally present in small numbers, and they reach outbreak levels only when an abundance of breeding material is available. Usually, the trees were attacked first by *Dendroctonus* and later by *Ips*, but the order was sometimes reversed. Other insects that found the infested trees suitable as breeding sites are listed and details are given of the type of damage caused by the borers, its effect on tree growth and the extent of tree mortality. These results and records of earlier outbreaks indicate that an increase in the bark-beetle population may be expected to follow a severe outbreak of *C. fumiferana* in areas supporting *P. glauca* as well as balsam fir [*Abies balsamea*], with a consequent loss of many spruce trees that appear to have survived the earlier defoliation; this should be taken into consideration in plans for the salvage of infested trees.

Blais (J. R.). **The vulnerability of balsam fir to spruce budworm attack in northwestern Ontario, with special reference to the physiological age of the tree.**—*For. Chron.* **34** no. 4 pp. 405–422, 2 graphs, 7 refs. Toronto, 1958.

The relation between the condition of balsam fir (*Abies balsamea*) and attack by *Choristoneura fumiferana* (Clem.) was investigated in north-western Ontario; the infestation in the study area began about 1940 and extended each year, and data collected from several plots over a period of 11 years showed that death of small suppressed trees growing under mature ones began in the third year of severe defoliation, and death of merchantable trees after 4–7 years. Once it began in a stand, tree mortality was rapid, increasing from 25 to 75 per cent. in two years, and it was to some extent independent of subsequent defoliation. Trees died sooner if they lost both old and current foliage than if only the current growth was affected, if they had reached the flowering stage than if they were immature (because of the greater amounts of defoliation to which they were subjected), and if they were grown near mature balsam fir and white spruce [*Picea glauca*] than if they were near deciduous trees. Those growing on poor soil offered least resistance to defoliation.

Prentice (R. M.) & Campbell (A. E.). **Volume loss of pulpwood in Manitoba caused by wood borers.**—*For. Chron.* **35** no. 2 pp. 142–145, 4 figs., 2 refs. Toronto, 1959.

In Manitoba, pulpwood cut in winter cannot always be hauled until after the next summer, during which period it is subject to attack by wood borers. The consequent loss in volume of jack pine [*Pinus banksiana*] and black spruce [*Picea mariana*] was investigated in 1956. The average number of borer holes per sq. ft. of log surface was 4·8 in pine and 6·5 in spruce, and losses in volume were about twice as high in the spruce as in the pine. Surface feeding by the larvae caused more loss than tunnelling in spruce but less in pine, and losses from both seldom exceeded 1·5 per cent. of the volume of sample logs and would not have warranted chemical control, even though borer populations were unusually high. Longicorn larvae were mainly responsible, the Lamiid, *Monochamus scutellatus* (Say), causing more damage than the principal Buprestids, *Melanophila* sp. and *Chrysobothris* sp.

Oatman (E. R.). **Intraspecific competition studies of the melon leaf miner, *Liriomyza pictella* (Thomson) (Diptera: Agromyzidae).**—*Ann. ent. Soc. Amer.* **53** no. 1 pp. 130–131, 1 fig., 3 refs. College Park, Md., 1960.

Field observations in California in 1954–55 indicated that heavy infestations by *Aphis gossypii* Glov. and *Tetranychus* spp. on melon were detrimental to increase in the population of *Liriomyza pictella* (Thoms.) mining the leaves affected, and evidence of intraspecific competition was also found. This appeared again in the course of laboratory studies [*R.A.E.*, A **48** 511], when there appeared to be more larvae mining the leaves of bean plants exposed to oviposition for 24 hours than in those exposed for 72. In experiments to verify this, bean plants were exposed to high populations of adults for 2–48 hours or to individual females for 24–72 hours. The results showed that the numbers of larvae increased with the exposure period, but that the mortality rate also did so. The larvae that hatched first consumed most of the leaf tissue and adversely affected the development of the remainder. There was also numerical evidence of competition between parent females for oviposition sites. There were no differences in the average weights of pupae obtained per plant, but there was a difference in the average weight of pupae from heavily mined leaves. When the leaves were so damaged that they dropped, only the full-fed larvae in them pupated and the pupae were small and adult emergence was reduced. The findings help to explain the sudden decline from high numbers that occurs in the field before parasites become numerous.

Smith jr. (C. A.). **Drosophilidae found in tomato fields in Indiana.**—*Proc. Ind. Acad. Sci.* **67** (1957) pp. 138–144, 6 refs. Indianapolis, Ind., 1958.

The contamination of tomatos grown for processing in the United States by Drosophilids has constituted a problem of recent years [*cf. R.A.E.*, A **45** 278; **48** 476]. In this paper, the author gives the results of trapping experiments in three tomato fields in Indiana in 1956, in which 13 species were taken, and of rearing tests in which ten species were obtained from ripe tomatos. In both cases, *Drosophila melanogaster* Mg. represented more than half the number of individuals.

Guyer (G.) & Wells (A.). **Evaluation of insecticides for control of the chlorinated hydrocarbon resistant onion maggot.**—*Quart. Bull. Mich. agric. Exp. Sta.* **41** no. 3 pp. 614–623, 2 figs., 2 refs. East Lansing, Mich., 1959.

The following is based on the authors' introduction and summary. In Michigan, *Hylemyia antiqua* (Mg.), which had been successfully controlled on onion with chlorinated hydrocarbons since 1951, showed signs of resistance to them in laboratory tests in the winter of 1956–57, and field tests in three widely separated places showed that populations of resistant larvae were present in all the major onion-growing areas by the autumn of 1957, though the populations differed considerably. Field-plot tests in the three districts in 1958 showed that treatment of the open furrow at the time of sowing with 2 lb. 3 per cent. diazinon dust or 2 per cent. granular Am.Cyanamid 18133 [O,O-diethyl O-2-pyrazinyl phosphorothioate] or with 1 lb. 2 per cent. granular phorate (Thimet) or dimethoate (Am.Cyanamid 12880) resulted in the best yields; several other materials caused significant yield increases, and granular or dust formulations were more effective than liquid treatments at comparable rates.

Butcher (J. W.) & Haynes (D. L.). **Experiments with new insecticides for control of European pine shoot moth.**—*Quart. Bull. Mich. agric. Exp. Sta.* **41** no. 3 pp. 734–744, 5 refs. East Lansing, Mich., 1959.

In field tests in 1958 on the control of the European pine shoot moth [*Rhyacionia buoliana* (Schiff.)] on young trees of red pine (*Pinus resinosa*) in Michigan [*cf. R.A.E.*, A **49** 77], applications on 17th–19th April of 2 lb. dimethoate (Am.Cyanamid 12880), DDT or Am.Cyanamid 18706 (O,O-dimethyl S-ethylcarbamoylmethyl phosphorodithioate), 1 lb. mevinphos (Phosdrin) or 4 lb. Sevin per 100 U.S. gal. gave 100, 97, 95, 97 and 91 per cent. reduction, respectively, in the numbers of living larvae on 22nd May, and six of 11 other materials significantly reduced the population.

In summer tests, all treatments were ineffective when made on 24th–27th June, but 1 lb. phosphamidon or Shell SD 4402 (1,3,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanophthalan) and 2 lb. dimethoate or DDT per 100 U.S. gal. and two formulations of DDT in oil caused about 75–100 per cent. reduction in population when applied on 9th July; apparently, a toxic residue should persist on the plant throughout the late hatching period if control is to be achieved.

Duncan (D. P.) & Hodson (A. C.). **Influence of the forest tent caterpillar upon the aspen forests of Minnesota.**—*For. Sci.* **4** no. 1 pp. 71–93, 11 figs., 14 refs. Washington, D.C., 1958.

Outbreaks of *Malacosoma disstria* Hb. occur at intervals of about ten years in deciduous forests in northern Minnesota, have been of increasing intensity and duration and are expected to cause serious losses in the future by defoliating quaking aspen (*Populus tremuloides*). During the outbreak of 1948–54, severe defoliation did not kill *P. tremuloides* or result in increased loss due to attack by *Saperda calcarata* Say or fungi of the genus *Hypoxylon*, and the increase in the radial growth of balsam fir [*Abies balsamea*] growing beneath the trees was less than a third of the decrease in radial growth of the aspen. Defoliation of aspen may favour regeneration of pine, where seedlings occur, but this is probably short-lived, and the main effect of

M. disstria on timber values is the reduction in aspen growth. The extent of this under various conditions is discussed and related to the possible value of control by aeroplane spraying, and it is concluded that though this is not economic at present, it may become so if the value of aspen timber rises.

York (G. T.). **Field tests with the fungus *Beauveria* sp. for control of the European corn borer.**—*Iowa St. Coll. J. Sci.* **33** no. 2 pp. 123–129, 13 refs. Ames, Iowa, 1958.

The following is based on the author's summary. In investigations in Iowa, a fungus of the genus *Beauveria*, isolated from diseased larvae of *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.), was cultured on sterile bran in the laboratory, and spores from the cultures were applied in different media to maize plants for the control of *O. nubilalis*. In 1955, sterilised dry maize meal as the carrier resulted in 91 per cent. average reduction in the numbers of first-generation larvae, as compared with 79 per cent. for granulated attapulgite. A dust and sprays were less effective, though they caused appreciable mortality. In 1956, maize meal was again better than attapulgite as a carrier, and increasing the amount of spores increased the kill. Poor results were given against second-generation larvae in both years. It is noted that exposure to heavy concentrations of the spores produced marked symptoms of debilitation in the author.

Ware (G. W.) & Gilmore (L. O.). **Excretion of BHC in milk from dairy cows fed known amounts of BHC.**—*Res. Circ. Ohio agric. Exp. Sta.* no. 68, 15 pp., 6 figs., 17 refs. Wooster, Ohio, 1959.

In an experiment in Ohio in 1957, lactating cows were given grain treated with 1–125 parts BHC (40 per cent. γ isomer) per million each morning and as much hay as they would eat later in the day. After 50 days, the BHC treatment ceased, and the cows were turned out to pasture. Samples of their milk, taken 1, 3, 5, 7 and 10 days after the beginning of the experiment and then at weekly intervals until lactation ceased or BHC disappeared from them, were analysed for BHC chemically and for γ BHC by bioassay with adults of *Musca domestica* L.

The results showed that, during the 50 days of treatment, the amounts of BHC in the milk increased with time for cows receiving 125 p.p.m. BHC, but not for those receiving 1–25 p.p.m. and that there was a direct relation between the dosage of BHC, in mg. per kg. body weight, and the amount that appeared in the milk during feeding. After feeding with BHC had ceased, the compound could be detected in the milk for up to 34 and 52 days in animals fed with 1 and 5 p.p.m., respectively, and for more than 102 and 171 days in those fed with 25 and 125 p.p.m., but γ BHC was not detected in any sample by bioassay more than 52 days after the end of BHC feeding, and pentachlorocyclohexene, a possible metabolite of BHC, was not detected in any sample either during or after feeding.

Hays (S. B.) & Arant (F. S.). **Insecticidal baits for control of the imported fire ant, *Solenopsis saevissima richteri*.**—*J. econ. Ent.* **53** no. 2 pp. 188–191, 4 refs. Menasha, Wis., 1960.

Investigations on the possibility of economical control of *Solenopsis saevissima richteri* Forel on farmlands with baits containing toxicants in amounts that would not be harmful to other organisms were carried out in

Alabama in 1957–59. The following is largely the authors' abstract of this account of the work. In laboratory and field tests, baits containing tankage (50 per cent. protein, meat and bone scraps), fish meal, ground insects, processed vegetable cooking oils, digested maize and soy-bean protein with fat, groundnut butter and other mixtures high in protein, fat or both were the most attractive of more than 400 bait formulations tested; heptachlor and Kepone [2,3,3a,4,5,6,7,7a,8,8-decachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene-1-one] were acceptable to the ant and gave more effective control than 27 other insecticides. Groundnut butter containing 0·125 per cent. Kepone was the most effective bait tested in small- and large-plot field experiments, eliminating all colonies of the ant when applied at the rate of 4–6 lb. per acre. It was injected into drinking straws with a grease gun to facilitate application, the straws being distributed mechanically or by hand in the field; other promising Kepone baits were prepared as pellets from equal parts of groundnut butter and groundnut meal and as polymerised granules of groundnut butter.

Lichtenstein (E. P.) & Schulz (K. R.). **Epoxidation of aldrin and heptachlor in soils as influenced by autoclaving, moisture, and soil types.** —*J. econ. Ent.* **53** no. 2 pp. 192–197, 4 graphs, 12 refs. Menasha, Wis., 1960.

In laboratory tests, the persistence of insecticides in soils and sands, of which some samples were autoclaved and others untreated before the addition of the insecticides, was investigated; all the autoclaved and half the untreated samples were watered once a week throughout a test. Aldrin, applied to autoclaved and to wet and dry untreated loam soil at the rate of 10 parts per million, was changed into dieldrin [*cf. R.A.E.*, A **47** 56] readily in the wet soil, but much less so in the autoclaved and least of all in the dry soil, but there was little epoxidation when it was applied to sand or when heptachlor was applied to soil. It is concluded that little aldrin is transformed to dieldrin in soil in which micro-organisms are scarce or show little activity, and that heptachlor persists rather longer and forms less of its epoxide than does aldrin. The total amount of toxicant recorded after the application of aldrin was greater in muck than in loam soil. Lindane [almost pure γ BHC], applied to a silt loam, was more persistent in dry and less in moist soil than in autoclaved soil. In field tests on loam soil, heptachlor was again more persistent than aldrin. Quantities of aldrin and dieldrin were equal after three months in the laboratory and after 16 months in the field.

Wilson (M. C.), Hodges (H. F.), Gallun (R. L.) & Kirk (R. E.). **The use of phorate to control aphids and the Hessian fly on winter wheat.**— *J. econ. Ent.* **53** no. 2 pp. 197–200, 1 fig., 7 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. Field experiments were carried out in Indiana in 1957–59 to determine the effect of phorate in controlling insects on wheat. A randomised block design with all treatments replicated four times was used. Winter wheat was sown with a grain drill in September and harvested with a combine. Few insects were present in 1957, but there were heavy infestations of *Mayetiola* (*Phytophaga*) *destructor* (Say), *Rhopalosiphum fitchii* (Sand.), and *Macrosiphum avenae* (F.) (*granarium* (Kby.)) in 1958, and phorate was applied to the seed to control them in the autumn and broadcast as granules early in the following April for control in spring. Seed treatment with 0·5 lb. phorate per 100 lb.

seed controlled all three insects, and the spring generation of *Mayetiola* was controlled by 1·75 lb. phorate per acre in 10 per cent. granules. Highly significant increases in yield were obtained with all treatments that gave control, though the seed treatment reduced germination, and plots that were clipped to simulate grazing in the autumn yielded 4–6 bushels more per acre than others, regardless of insecticide treatment.

Corkins (J. P.) & Hazel (N. W.). **Field control of cotton mites with Aramite aerial spray in California.**—*J. econ. Ent.* **53** no. 2 pp. 203–205, 5 refs. Menasha, Wis., 1960.

In view of the undesirable drift to other crops when dusts containing Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite) are applied by aeroplane for the control of mites on cotton in California, sprays of the acaricide in oil were tested in 1959. Preliminary tests with six oils having shown that Mobil GPD 1442 was not phytotoxic, 1·5 lb. Aramite per acre was applied in 2 U.S. gal. oil solution, or in emulsion concentrate diluted with 10 U.S. gal. water per acre, in small-scale tests. An emulsion concentrate containing 8 lb. technical Aramite (90 per cent. pure) per U.S. gal. gave the best results, and, in field tests in which it was applied by aeroplane, it gave fair or good economic control of a complex of mites consisting mainly of *Tetranychus telarius* (L.), with small numbers of *T. atlanticus* McG. and *T. pacificus* McG., and had no phytotoxic effect. Numerous unidentified predacious mites that were present did not seem to be greatly affected.

Casida (J. E.), Augustinsson (K. B.) & Jonsson (G.). **Stability, toxicity, and reaction mechanism with esterases of certain carbamate insecticides.**—*J. econ. Ent.* **53** no. 2 pp. 205–212, 2 graphs, 33 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. Details are given of laboratory experiments in which 30 N-alkyl- and N,N-dialkylcarbamates, including Sevin, Isolan, Pyrolan and dimetan, were compared for their stability, activity as inhibitors of acetyl- and butyrylcholinesterase and toxicity to *Musca domestica* L. and mice. A distinctive structural specificity, unrelated to stability, was observed for each type of biological activity. The compounds varied greatly in their inhibitory specificity for acetyl- and butyrylcholinesterase and in the rate of attaining an equilibrium of cholinesterase, carbamate and acetylcholine during assay. Plasma albumin was found to hydrolyse p-nitrophenyl N-alkylcarbamates, whereas plasma cholinesterase or arylesterase had little effect, and chymotrypsin and human-plasma butyrylcholinesterase did not react with the carbamates as they did with the acetates, ethyl carbonates and dialkyl phosphates derived from the same enols. These results indicate that competition rather than carbamoylation is the primary mechanism of cholinesterase inhibition, and presumably of toxicity, for the carbamates studied.

Krause (G. F.) & Pedersen (J. R.). **Estimating immature populations of rice weevils in wheat by using subsamples.**—*J. econ. Ent.* **53** no. 2 pp. 215–217, 1 graph, 3 refs. Menasha, Wis., 1960.

Details are given of laboratory tests in Kansas to develop a suitable method of sampling to estimate the effect of fumigants on the immature

stages of *Sitophilus oryzae* (L.) within wheat grains. The following is based on the authors' summary of the work. Wheat was infested at three population levels with insects from cultures of two ages, each variation being replicated three times. Each replicate was subdivided into six, and each of the resulting divisions was sampled four times when the insects had reached a particular stage of development from egg to pupa. Infestation by immature stages was determined by counting adult emergence from samples. The effect of various factors on total emergence was studied by a mixed classification (factorial, nested) analysis of variance. This showed that the age of the culture had no effect on total emergence; that the level of infestation accounted for more than 63 per cent. of the total variation; that greater efficiency could be obtained by using a single source of infested wheat; and that consistency could be improved by taking samples for control and treatment from a population that contained a relatively high percentage of one stage. A table for the estimation of the number of samples necessary to obtain reliable estimates of immature infestation is given.

Hamstead (E. O.) & Gould (E.). **Control of the woolly apple aphid on roots of apple nursery stock.**—*J. econ. Ent.* **53** no. 2 pp. 217–220, 1 fig., 2 refs. Menasha, Wis., 1960.

The following is virtually the authors' abstract of this account of experiments carried out in Virginia and Pennsylvania in 1953–58. Suspensions of BHC, lindane [almost pure γ BHC] and aldrin, used at 20 lb. per acre, and of dieldrin at 40 lb., applied to the soil surface in bands about the tree rows a few days after planting, gave complete protection against *Eriosoma lanigerum* (Hsm.) on the roots of apple nursery stock without injuring the trees. Such heavy dosages are impractical, and lighter ones failed to give complete control. Heavy dosages of demeton and chlordane were ineffective. Dipping the roots of apple seedlings into pastes made of 1–2 teaspoonsful of 10 per cent. γ BHC, 50 per cent. dieldrin or 25 per cent. aldrin wettable powder, with 1·5 lb. Attaclay or charcoal and 1 U.S. quart water, reduced infestation and did not injure the trees, but was cumbersome to carry out. In trunk-spray experiments, the application of moderate dosages of BHC, Sevin, demeton or azinphos-methyl (Guthion) to the trunks near the ground and to a narrow band of soil about the tree rows gave promising control and caused no injury. The minimum effective dosages remain to be determined. Trithion, schradan and Nemagon (1,2-dibromo-3-chloropropane) were less effective.

Simpson (R. G.) & Burkhardt (C. C.). **A three-year overwintering study of the spotted alfalfa aphid.**—*J. econ. Ent.* **53** no. 2 pp. 220–222, 1 ref. Menasha, Wis., 1960.

Investigations carried out in the eastern third of Kansas in December–April in 1956–59 showed that, in the southern portion, *Therioaphis maculata* (Buckt.) survived the winter in lucerne fields in all three years; on roadside embankments facing south it survived as far north as Manhattan in the first two winters and up to the northern boundary in the last. Alates were found until about the first week in February each year, after which only apterae, of all instars, were present; alates reappeared in late March or early April and gradually increased in numbers as the season progressed. Winter survival was not affected by the height of the lucerne or the presence of windbreaks.

Evans (W. G.) & Gyrisco (G. G.). **The flight range of the European chafer.**—*J. econ. Ent.* **53** no. 2 pp. 222–224, 9 refs. Menasha, Wis., 1960.

Observations were made on the flight range of *Amphimallon majalis* (Razoum.) in New York in 1954–59. Each evening during the flight season, beetles were collected from a conspicuous tree growing on a hill and about 60 yd. from its nearest neighbour, marked with fluorescent enamel of a particular colour and placed under a light layer of soil at various distances and in various directions from it, but covered with cages to prevent flight on the day of marking. The cages were removed on the following day. Evening captures of marked beetles from the tree showed that they reached it from distances of up to 725 yd. on the day on which they were released. As the beetles make an average of five mating flights [*cf. R.A.E.*, A **48** 364], they could thus travel a total distance of 4–5 miles. They show no tendency to fly in any particular direction until near trees, to which they are attracted.

Wilcox (J.) & Howland (A. F.). **Control of the two-spotted spider mite on beans with systemic insecticides applied in the soil.**—*J. econ. Ent.* **53** no. 2 pp. 224–227, 1 ref. Menasha, Wis., 1960.

In tests of various systemic compounds under conditions of light infestation in southern California in 1956–58, lima beans were protected from attack by *Tetranychus telarius* (L.) for 2–3 months by applications of phorate or Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate) in granules or emulsion concentrates to the furrow at sowing time. In limited tests, demeton and dimethoate in emulsion concentrates similarly applied showed promise, and adding phorate or Di-Syston to the seed coatings normally used against insects and fungi was also effective. Dosages of less than 1 lb. per acre were as effective as higher ones and not appreciably phytotoxic; they resulted in increased crop yields and little or no residue in the dry beans, whereas higher dosages reduced plant stands. Phorate, demeton, Di-Syston and dimethoate gave promising control when applied in foliage sprays in some tests, and when it is necessary to control *Lygus* at or near flowering time, it may be more beneficial to apply a single spray against both pests. When applied in the furrow, phorate was more effective than Di-Syston against *Frankliniella moultoni* Hood, which is not usually an important pest, but a dosage of 2–4 lb. per acre was necessary.

Walker jr. (J. K.) & Hanna (R. L.). **Control of boll weevils resistant to chlorinated hydrocarbons.**—*J. econ. Ent.* **53** no. 2 pp. 228–231, 2 refs. Menasha, Wis., 1960.

Because cotton growers had found *Anthonomus grandis* Boh. difficult to control with chlorinated-hydrocarbon insecticides in two counties in south-central Texas, 15 replicated field-plot experiments were carried out in the area in 1956–58 to compare various insecticides against it.

When applied to the plants 5–15 times at 5-day intervals during the period of infestation by *A. grandis*, azinphos-methyl (Guthion) and Sevin in dusts and sprays and calcium-arsenate dusts gave the best control of late-season attack; methyl-parathion and malathion gave good immediate kill, but did not always prevent excessive damage unless applied more frequently. Chlorinated hydrocarbons (chiefly DDT and toxaphene) varied

considerably in effectiveness at the different localities; they reduced infestation in some tests, but never enough to give economic control, and were generally the least effective of the insecticides tested.

In sprays against the overwintered weevils in 1958, malathion and Trithion were more effective than toxaphene, giving effective control at a rate of 1 lb. per acre.

Howe (W. L.) & Pesho (G. R.). **Spotted alfalfa aphid resistance in mature growth of alfalfa varieties.**—*J. econ. Ent.* **53** no. 2 pp. 234–238, 2 figs., 6 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. In tests in California in 1957, mature stands of lucerne of varieties of domestic and foreign origin showed a wide range in suitability for population increase and plant injury by *Therioaphis maculata* (Buckt.). The resistant varieties, Lahontan, Moapa, Zia, Bam and Sirsa no. 9, supported only low populations and made excellent growth under conditions of epidemic infestation at high temperatures, whereas 43 other varieties, classed as intermediate or susceptible, supported heavy populations and showed injury to different degrees. A wide range in tolerance was indicated by mortalities of 2–90 per cent. or more in plants supporting at least 300 aphids per stem; varieties of Turkestan parentage were generally tolerant. The regrowth of infested varieties after being cut back varied inversely with plant mortality.

Ruppel (R. F.), Bravo (G.) & Hatheway (W. H.). **Effectiveness of mixtures of acrylonitrile and carbon tetrachloride against three pests of stored corn.**—*J. econ. Ent.* **53** no. 2 pp. 238–242, 1 fig., 13 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. Maize heavily infested by *Sitophilus oryzae* (L.), *Sitotroga cerealella* (Ol.) and *Tribolium castaneum* (Hbst.) in Colombia was fumigated for 24 hours with mixtures of acrylonitrile and carbon tetrachloride (1:2, 1:4, 1:6 and 1:8 by weight) at dosages of 0·05, 0·1 and 0·2 ml. fumigant per 3 litres of grain and compared with similar maize fumigated with a standard mixture of ethylene dichloride and carbon tetrachloride (3:1 by volume) used at 0·4 ml. per 3 litres. Counts of living adults showed good control by all the acrylonitrile mixtures at 0·2 ml. and the 1:2 one at 0·1 ml. immediately after fumigation, but only the 1:2 mixture at 0·2 ml. and the standard fumigant proved effective after six weeks. Indirect evidence of competition between *Sitophilus* and *Sitotroga* was observed. As the low dosages and concentrations of acrylonitrile were not satisfactory, the use of these mixtures as general grain fumigants in Colombia does not appear practicable.

Lukefahr (M. J.) & Rhyne (C.). **Effects of nectariless cottons on populations of three Lepidopterous insects.**—*J. econ. Ent.* **53** no. 2 pp. 242–244, 10 refs. Menasha, Wis., 1960.

The following is based largely on the authors' abstract. In tests in Texas in 1957–58, in which equal numbers of insects were caged on cotton of the variety Empire, which has extrafloral nectaries, and on a variety without them, populations of *Alabama argillacea* (Hb.) and *Trichoplusia ni* (Hb.) were found to be 7–10 times as great on the former as on the latter after about three weeks, but the numbers of *Pectinophora gossypiella* (Saund.) were not much affected.

O'Keeffe (L. E.), Callenbach (J. A.) & Lebsock (K. L.). **Effect of culm solidness on the survival of the wheat stem sawfly.**—*J. econ. Ent.* **53** no. 2 pp. 244–246, 8 refs. Menasha, Wis., 1960.

As solid-stemmed varieties of wheat have not always proved more resistant than hollow-stemmed ones to attack by *Cephus cinctus* Nort. [*cf. R.A.E.*, A **35** 338; **44** 272], six selections that appeared to have similar stems when measured by common techniques but varied in resistance to the sawfly were tested in four localities in North Dakota. Examination of the cross-section of the stem at the top as well as at the centre of the internode revealed marked differences in pith content between varieties, and sawfly survival, used as a criterion of resistance, was inversely related to it. Fertilisers had little influence on the stem solidity of the selections tested. Although many observations are necessary for accurate determination of the stem solidity of a particular selection, it is concluded that, with adequate sampling, even minor differences can be shown to have a significant effect on resistance to *C. cinctus*.

Drooz (A. T.). **White-pine shoot borer** (*Eucosma gloriola* **Heinrich**).—*J. econ. Ent.* **53** no. 2 pp. 248–251, 4 figs., 6 refs. Menasha, Wis., 1960.

Eucosma gloriola Heinr. was probably widespread in the north-eastern United States and Quebec when it was described from white pine (*Pinus strobus*) in Connecticut in 1930 [*R.A.E.*, A **20** 86], but it was subsequently misidentified as *Rhyacionia frustrana* (Comst.) where the damage or immature insects were observed on hard pines. In 1957–59, *E. gloriola* was found boring in the pith of the terminals of Scots pine (*P. sylvestris*) and *P. strobus* in Pennsylvania, and it also attacked small numbers of other pines (*P. resinosa*, *P. nigra*, *P. rigida*) and Douglas fir (*Pseudotsuga menziesii*). The distribution and life-history of the borer and the damage it causes are described, and it is reported that an undescribed species of *Glypta* parasitised about half the larvae in 1958 and 1959, the full-fed parasite larva overwintering in a cocoon within the cocoon of the host.

Harris jr. (E. D.). *Hyperodes humilis*, **a new pest of sweet corn in the Everglades, and its control.**—*J. econ. Ent.* **53** no. 2 pp. 251–257, 12 figs., 12 refs. Menasha, Wis., 1960.

The following is substantially the author's abstract. Mining by larvae of *Hyperodes humilis* (Gylh.) in the lower stems of young plants of sweet maize in the Everglades district of Florida in the spring and autumn of 1959 apparently caused the plants to become stunted, break over, wilt or die; this weevil was not previously known to attack cultivated plants. The best control was obtained by spraying with 2 lb. DDT or 1 lb. azinphos-methyl (Guthion) per 100 U.S. gal. at four-day intervals for about a month, beginning when the seedlings appeared, and directing the spray to the lower stems and surrounding soil. The adults fed on the stems and foliage of the young maize, but seemed to cause little damage.

Nielson (M. W.) & Currie (W. E.). **Biology of the convergent lady beetle when fed a spotted alfalfa aphid diet.**—*J. econ. Ent.* **53** no. 2 pp. 257–259, 13 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. Laboratory studies in Arizona in 1958 showed that when *Hippodamia convergens* (Guér.) was

allowed to feed on *Therioaphis maculata* (Buckt.), the egg, larval and pupal stages and development from egg to adult lasted 2, 7·6, 4·1 and 13·8 days, respectively. There were four larval instars, and the daily and total consumption of aphids in the later ones increased fairly regularly in arithmetical and geometrical progression, respectively. Laboratory-reared adult males and females and field-collected adults of both sexes lived longest on diets of 60, 90 and 30 aphids per day, respectively; most laboratory-reared adults lived longer than field-collected ones, and females from both sources generally lived longer than males. The duration of the immature stages was shorter and daily aphid consumption higher with *T. maculata* than when other aphids were provided as food.

Whitney (W. K.) & Kenaga (E. E.). **Distribution and sorption of liquid fumigants applied to wheat by recirculation.**—*J. econ. Ent.* **53** no. 2 pp. 259–261, 2 figs., 2 refs. Menasha, Wis., 1960.

Laboratory tests are described in which wheat containing 12·2 per cent. moisture was fumigated at 77°F. with Serafume (a mixture of carbon tetrachloride, ethylene dibromide, carbon bisulphide and ethylene dichloride (76·5:3·5:10:10 by weight)) in cylinders 6 ft. tall provided with a fan and side tube for the circulation of air (of the type termed recirculators), to study the sorption and vertical distribution of each fumigant component. The liquid fumigant was applied to the surface of the grain at the rate of 2 U.S. gal. per 1,000 bushels, and recirculation was begun immediately and continued for 30 minutes, making about 30 air changes in the wheat. Analysis by mass spectrometry and by thermal conductivity of gas samples, taken at five levels 0·5, 1, 4, 8 and 24 hours after the beginning of the test, showed that selective sorption occurred, mainly in the first 30 minutes, ethylene dibromide being sorbed most rapidly and to the greatest extent, followed in order by ethylene dichloride, carbon bisulphide and carbon tetrachloride. Nearly all the ethylene dibromide was sorbed in the upper layers during recirculation, though a small amount reached the bottom; the other components were fairly evenly distributed, but showed a slight tendency to settle downward after the longer periods. The approximate average ratio of carbon tetrachloride, carbon bisulphide, ethylene dichloride and carbon dioxide in gas samples taken from interstitial space after 24 hours was 87:7:1:5 by weight. About 65 per cent. of the total formulation was sorbed in 30 minutes and 85 per cent. in 24 hours.

Taschenberg (E. F.) & Avens (A. W.). **DDT deposits on grapes as affected by growth and weathering.**—*J. econ. Ent.* **53** no. 2 pp. 269–276, 7 graphs, 24 refs. Menasha, Wis., 1960.

Investigations on the influence of growth and weathering in reducing the deposits from DDT sprays applied to grapes for the control of *Paralobesia viteana* (Clem.) were carried out in 1949–57 in New York, where such sprays are usually applied twice against the first generation and once, about six weeks before harvest, against the second [*cf. R.A.E.*, A **41** 266]. Analysis of fruit samples collected between the last spray application and harvest showed DDT residues below the tolerance (7 parts per million at harvest) after application of the first two sprays or of three without a spreader; the latter, however, gave poor control. Three applications of 1·5 lb. 50 per cent. wettable DDT per 100 U.S. gal. with a fungicide and spreader gave DDT deposits of 17–22·8 p.p.m. immediately after the last application and

6·1–12 p.p.m. at the beginning of harvest in six of seven years. The contribution of each application to the deposit in a three-spray schedule is recorded. Growth and weathering caused reductions of 13–29 and 27–57 per cent., respectively, between the last application and harvest; the fungicide and adhesive used affected weathering, and the reduction was least when DDT was combined with a low-soluble copper fungicide with lime and an emulsible oil.

Kelsey (L. P.) & Stearns (L. A.). **Control of pear borer and American plum borer in apple trees.**—*J. econ. Ent.* **53** no. 2 pp. 276–278, 5 refs. Menasha, Wis., 1960.

Severe infestation by *Thamnosphecia pyri* (Harris), with some by *Euzophera semifuneralis* (Wlk.), was observed on the trunks of apple trees 9 and 15 years old in Delaware in July 1956. The larvae bored beneath loose bark to the cambium, causing characteristic oozing of the sap, and killed several trees. A spray of 2 U.S. quarts dormant oil and 1 lb. 10 per cent. γ BHC per 100 U.S. gal., applied to the trunks in March 1957, gave only about 60 per cent. kill, mainly because the insecticide did not reach the site of activity. Sprays containing 2 lb. 15 per cent. wettable parathion or 1 U.S. pint 47·5 per cent. parathion emulsion concentrate per 100 U.S. gal., applied at the rate of 3 U.S. gal. per tree and a pressure of 400 lb. per sq. in. on 24th May, with spray guns that produced a spray forceful enough to drive the materials under the bark and rip most of the loose bark away, gave complete control, with no reinfestation for two years.

Daniels (N. E.). **Greenbug control with systemic insecticides as influenced by fertilizer applications.**—*J. econ. Ent.* **53** no. 2 pp. 278–279, 4 refs. Menasha, Wis., 1960.

Outbreaks of *Toxoptera graminum* (Rond.) are common on small-grain crops on the High Plains of Texas. Since fertiliser practices vary there, greenhouse experiments were carried out to determine the effect of fertiliser combinations on control of the aphid by means of demeton and Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate). When these systemic insecticides were applied with fertilisers containing nitrogen, phosphorus or both to the soil in bands 1 in. below and 0·5 in. to the side of rows of wheat seeds in pots, they gave control little or no better than that given by insecticide without fertiliser, but when demeton was applied to the seed, control was rather better in the presence of fertiliser than without it.

Kirkpatrick (M. E.), Brogdon (J. L.) & DeViney (G. J.). **The effect of soil treatments of chlordane or heptachlor on the flavor of turnips, parsnips, and carrots.**—*J. econ. Ent.* **53** no. 2 pp. 285–287, 7 refs. Menasha, Wis., 1960.

In tests on turnips and parsnips in Maryland in 1956 and on carrots in California in 1958 and in South Carolina in 1959, comparison of crops grown in untreated soil and in soil treated with 3–6 lb. heptachlor or 5–10 lb. chlordane per acre showed no adverse effect of the insecticide on flavour, and a dosage of 20 lb. chlordane per acre did not affect that of carrots in California.

Pedersen (J. R.). **Susceptibility of certain stages of the rice weevil to a methallyl chloride fumigant formulation in wheat of various moistures.** —*J. econ. Ent.* **53** no. 2 pp. 288–291, 13 refs. Menasha, Wis., 1960.

The following is based on the author's abstract. In laboratory experiments, adults of *Sitophilus oryzae* (L.) in wheat containing 11, 12·5 and 14 per cent. moisture and eggs, first- and third-instar larvae and pupae of the weevil in wheat at the two higher moisture contents were fumigated with various amounts of a mixture of carbon tetrachloride and methallyl chloride (4:1 by volume) for 48 hours at 80°F. There appeared to be no recovery from knockdown, and most of the insects affected by the fumigant were dead within five days. The dosage necessary for a given kill of any stage increased as the moisture content of the wheat was increased. Comparison of the LC50's calculated from the mortality after ten days showed that the third-instar larva was less and the pupa and adult more susceptible than the egg and first-instar larva at 12·5 per cent. moisture content, whereas susceptibility increased progressively from the third instar to the first instar, pupa, egg and adult at 14 per cent. The LC90's were estimated graphically and showed that the first instar, pupa and egg were more susceptible than the third instar and less so than the adult at 12·5 per cent. moisture content, and that susceptibility increased progressively from the third instar to the pupa, first instar, egg and adult at 14 per cent. The fumigant mixture was about equal to one of carbon tetrachloride and carbon bisulphide (4:1) at the LC50, but slightly more effective than the latter at the LC90.

Miner (F. D.). **Cotton insects in Nicaragua.**—*J. econ. Ent.* **53** no. 2 pp. 291–296, 6 refs. Menasha, Wis., 1960.

The following is based largely on the author's abstract. The most important pests of cotton in Nicaragua are *Anthonomus grandis* Boh. and *Sacadodes pyralis* Dyar [*cf. R.A.E.*, A **41** 216–217]. The former passes the dry season between crops in old cotton fields, apparently without reproducing, and early infestations in young cotton are heaviest in fields sown before the usual date. The life-cycle is similar to that in the United States, and infestation is greatest when the crop is approaching maturity. *Sacadodes*, which also injures the bolls, is generally a late-season pest and is particularly injurious in late-sown fields. In preliminary tests, populations of both insects were reduced by insecticides, particularly sprays of azinphos-methyl (Guthion) and endrin, but increases in yield were small. Pests of minor importance include *Alabama argillacea* (Hb.), *Aphis gossypii* Glov., *Heliothis zea* (Boddie) and a species of *Estigmene*, possibly *E. acraea* (Dru.); species of *Prodenia* occasionally damage the bolls, *Feltia* and *Acrolophus* spp. cut off young plants, especially in early-sown fields, and leaf-cutting ants (*Atta* spp.) damage border rows. *Pectinophora gossypiella* (Saund.) is not present.

Carter (Walter). **A study of mealybug populations (*Dysmicoccus brevipes* (Ckl.)) in an ant-free field.**—*J. econ. Ent.* **53** no. 2 pp. 296–299, 2 figs. Menasha, Wis., 1960.

Although ants are eliminated from pineapple fields in Hawaii, large subterranean colonies of *Dysmicoccus brevipes* (Ckll.) can apparently develop in their absence. The biology of these colonies appears to require the

occasional movement of small numbers of the insects up to the leaves, where feeding results in very small atypical green spots. Experiments in a field of 12 blocks, half of which were given the standard spray treatment, showed that, in the absence of ants, there were so few mealybugs on the leaves that spraying made no difference to the number of plants infested or the number of insects per plant; the small leaf colonies were undoubtedly temporary extensions of the underground ones. The incidence of scattered plants showing wilt was roughly correlated with that of the subterranean colonies, but was much lower on old roads that had been ploughed up, where plant growth was better than in other parts; as such improved growth is ascribable to partial sterilising of the soil, the occurrence of wilt may be due to the cumulative establishment by the mealybug of sites of entry for weak root pathogens.

Brunson (M. H.). **Effect of parathion on parasites of oriental fruit moth cocoons and *Trichogramma minutum* in peach orchards.**—*J. econ. Ent.* **53** no. 2 pp. 304–306, 11 refs. Menasha, Wis., 1960.

Some peach orchards in New Jersey are sprayed with 4 oz. parathion per 100 U.S. gal. at the shuck-split stage and again 10 and 20 days later against *Cydia* (*Grapholitha*) *molesta* (Busck) and *Conotrachelus nenuphar* (Hbst.), and others with 2 lb. lead arsenate and 10 lb. hydrated lime per 100 U.S. gal. at shuck-split and ten days later, which controls *C. nenuphar* but has little effect on *C. molesta* or its parasites. Investigations in 1956 and 1957 on the effects of the parathion treatment showed that parasitism of *Cydia* cocoons exposed from May to August was about 86 per cent. lower in orchards sprayed with parathion than in those receiving lead arsenate and that nearly three times as many parasite species were reared from the cocoons in the latter. Exposure of eggs of *C. molesta* for two days each week from May to August in the two years resulted in parasitism by *Trichogramma minutum* Ril. in 29 and 57 per cent. of the exposure periods in the orchards sprayed with parathion and in 50 and 75 per cent. of them in those treated with lead arsenate. In the orchards sprayed with parathion, parasitism of the cocoons was comparatively low through most of the growing season, but *T. minutum* appeared fairly soon after the last application of parathion in 1957, though it was slower in doing so in 1956.

Dobson (R. C.), Throneberry (G. O.) & Belling (T. E.). **Residues in established alfalfa treated with granulated phorate (Thimet) and their effect on cattle fed the hay.**—*J. econ. Ent.* **53** no. 2 pp. 306–310, 11 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. Granules containing phorate (Thimet), which have given good control of *Therioaphis maculata* (Buckt.) on lucerne in New Mexico [*cf. R.A.E.*, A **47** 242], were applied to plots at 1 or 4 lb. per acre immediately after cutting and before irrigation in 1958. Two groups of five steers were fed for one month with lucerne harvested from them 27 days later, and another group with hay from an untreated plot; all groups received untreated hay for a second month. Cattle fed with hay from the heavily treated and untreated plots gained weight less rapidly and more rapidly, respectively, than those receiving hay from the lightly treated one, but the differences were not significant. The differences were still smaller during the second month, but a reduction in the numbers of animals invalidated the comparison.

Residues on lucerne samples taken during the period of growth after treatment were determined by an electrometric technique involving inhibition of blood-plasma cholinesterase. Maximum residues of 154–626 and 295–745 parts per million for the lower and higher rates of treatment, respectively, were found on the third day after treatment. Samples from the 1-lb. plot showed no residues on the 14th day, whereas those from the 4-lb. plot continued to show residues until the 21st day, with possible traces on the 25th, but none was found in air-dried hay that had been harvested from this plot on the 27th day.

The cholinesterase activity of blood samples taken periodically from the steers during the feeding period was determined spectrophotometrically. Considerable variation was found between animals within groups and between sampling dates in individual animals, and no evidence was found to indicate that the blood cholinesterase was appreciably affected by the ingestion of hay from either of the two treated plots.

Burkhalter (G. F.) & Arant (F. S.). **Boll weevil susceptibility to toxaphene, endrin, and Guthion in five Alabama localities.**—*J. econ. Ent.* **53** no. 2 pp. 311–313, 6 graphs, 8 refs. Menasha, Wis., 1960.

The following is based largely on the authors' abstract. Since *Anthonomus grandis* Boh. had shown increased resistance to certain chlorinated-hydrocarbon insecticides in some cotton-growing areas of the United States [*cf. R.A.E.*, A **46** 344, 450], the susceptibility of adults from five localities in Alabama to toxaphene, endrin and azinphos-methyl (Guthion) was tested in the laboratory in 1956 and 1957. About 25,000 weevils reared from cotton squares were treated topically with technical insecticide, dissolved in acetone, two days after emergence and examined for mortality 72 hours later. There were no outstanding differences between the two years. In 1957, the LD50's in μg. per g. body weight were 12·5–61·8 for toxaphene, 0·8–3·5 for endrin and 0·9–2·3 for azinphos-methyl, and there was no evidence of acute resistance to any insecticide from any locality. Variations in mortality between times of year and between years were as great as those between localities.

Miller (W. E.). **Discovery in Michigan of *Orgilus obscurator* (Nees), a foreign parasite of the European pine shoot moth.**—*J. econ. Ent.* **53** no. 2 p. 318, 5 refs. Menasha, Wis., 1960.

Orgilus obscurator (Nees) was found parasitising overwintering larvae of *Rhyacionia buoliana* (Schiff.) on red pine (*Pinus resinosa*) and mugo pine (*P. mugo*) in three localities in south-eastern Michigan in 1957 and 1958. It had probably spread there from Ontario, but might have been introduced at the same times as its host [*cf. R.A.E.*, A **48** 522]. As it is evidently adapted to the conditions of Michigan, its value in controlling *R. buoliana* should be investigated.

George (B. W.), Raun (E. S.), Peters (D. C.) & Mendoza (C.). **Artificial medium for rearing some Lepidopterous corn insects.**—*J. econ. Ent.* **53** no. 2 pp. 318–319, 2 refs. Menasha, Wis., 1960.

The authors report that a diet similar to one already noticed [*R.A.E.*, A **39** 440], containing ground lucerne as the plant constituent, proved satisfactory for rearing *Heliothis zea* (Boddie) and *Agrotis ypsilon* (Hfn.)

as well as *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) in the laboratory. Newly hatched larvae of *H. zea* did not survive on the medium, but developed almost normally on it if fed on maize silks until after the first moult, taking 15·5 days at 85°F. from the second instar to pupation. *A. ypsilon* required 31 days for development. In tests with other Lepidoptera, newly hatched larvae of *Pseudaletia unipuncta* (Haw.) passed through several instars on the medium but did not pupate, and field-collected late-instar larvae of *Spodoptera* (*Laphygma*) *frugiperda* (J. E. Smith) completed their growth, pupated and transformed to adults. Field-collected larvae of *Colias eurytheme* Boisd. and *Simyra henrici* (Grote) failed to feed on the medium.

Pfadt (R. E.). **Control of army cutworms in alfalfa during 1959.**—*J. econ. Ent.* **53** no. 2 pp. 319–320, 6 refs. Menasha, Wis., 1960.

In tests of the toxicity of recent insecticides to larvae of *Chorizagrotis auxiliaris* (Grote), carried out in a lucerne field in Wyoming in late April 1959, counts made after a fortnight showed that treatment of the soil and vegetation with 0·08 lb. Shell SD 4402 (1,3,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanophthalan), 0·5 lb. Thiodan, 0·2 lb. endrin or 0·5 lb. dieldrin in 12·25 U.S. gal. emulsion spray per acre gave effective control of larvae in the sixth instar, with no significant difference between them, whereas emulsion sprays of 2 lb. Sevin or 0·25 lb. dieldrin per acre gave poor control and 0·2 lb. endrin or 0·5 lb. dieldrin per acre in granules was ineffective [*cf. R.A.E.*, A **44** 132].

Polivka (J. B.). **The biology and control of turf grubs.**—*Res. Bull. Ohio agric. Exp. Sta.* no. 829, 30 pp., 4 figs., 14 refs. Wooster, Ohio, 1959. **Small amounts of insecticides effective in controlling grubs of the Japanese beetle.**—*J. econ. Ent.* **53** no. 2 p. 320, 2 refs. Menasha, Wis., 1960.

In the first of these papers, the author gives notes on the bionomics of *Popillia japonica* Newm., *Cyclocephala borealis* Arr. and *Lachnosterna* (*Phyllophaga*) spp. in Ohio, where the first two have one generation a year and development of the others lasts three years, together with the results of experiments on the long-term control of the larvae in turf by means of insecticides. Treatment with 12·5, 25 and 37·5 lb. DDT per acre in October 1945 gave about 50, 72 and 100 per cent. control of *P. japonica* in 1957, and applications of 25 lb. DDT, 10 lb. BHC and 5 lb. chlordane in September 1946 gave complete control in October 1957, whereas 5 lb. BHC and 1 lb. chlordane began to lose effect after about six years. Further experiments confirmed the prolonged effectiveness of DDT and chlordane, but lead arsenate at 435 lb. per acre gave inconsistent results in different tests, probably owing to differences in the soils. Practically complete control was given by 1 lb. heptachlor after eight years, 5 lb. isodrin or endrin after five, 1 lb. dieldrin or 6 lb. toxaphene after 4½, and 3½ lb. aldrin after four years. All these insecticides were less effective in eliminating larvae that were in the soil at the time of application than in preventing subsequent infestation. Parathion gave rather better immediate but poorer residual control than DDT or chlordane. Counts of *C. borealis* 1–3 years after insecticide applications showed complete control by 1 lb. dieldrin, 3·5 lb. aldrin, 5 lb. chlordane or heptachlor, 6 lb. toxaphene and 435 lb. lead arsenate per acre, and 3 lb. dieldrin, 3·5 lb. aldrin, 5 lb. heptachlor and 24 lb. toxaphene per acre gave complete control of *Lachnosterna* spp. after three years.

In the second paper, the author examines these results and those of determinations of residues in the soil [*R.A.E.*, A **48** 296] and points out that although 1 lb. chlordane per acre ceased to give economic control of *P. japonica* at the end of the sixth year, it showed some control until the end of the eleventh, and that its threshold of effectiveness in the soil lay between 0·21 and 0·44 lb. per acre; that although 10 lb. BHC gave significant control for 12 years, some larvae were found in the treated plots after 6–7 years; and that chemical analysis showed no heptachlor but 0·06–1·62 lb. of its epoxide per acre in the soil nine years after application, which was sufficient to give complete control of *P. japonica*. It is evident that BHC should not be recommended for control of the larvae, but that chlordane and heptachlor are effective at very low concentrations. Aldrin is also recommended as, although no aldrin and only 0·31 lb. dieldrin was shown by chemical assay and only 0·14 lb. aldrin or 0·25 lb. dieldrin by bioassay of samples treated four years before with 3 lb. aldrin per acre, these residues gave complete control of *P. japonica*.

Moore (D. H.). **Thiodan, a promising chemical for control of the lesser peach tree borer.**—*J. econ. Ent.* **53** no. 2 pp. 321–322, 5 refs. Menasha, Wis., 1960.

In a test in New York, sprays of 3 lb. 25 per cent. wettable Thiodan per 100 U.S. gal. were applied to the bark of peach trees at the rate of 8 U.S. gal. per tree and a pressure of 600 lb. per sq. in. on 18th June, 7th and 28th July and 18th August 1958, or on the first, first two or first three of these dates, for the control of *Aegeria* (*Synanthedon*) *pictipes* G. & R. Counts of larvae in April 1959 showed 93, 72, 87 and 93 per cent. corrected reduction in population, respectively, as compared with 100, 76, 88 and 96 per cent. reduction for similar treatments with a standard spray of 15 per cent. wettable parathion. It is concluded that three applications of Thiodan per season would give commercial control.

Carter (Walter). *Phenococcus solani* **Ferris, a toxicogenic insect.**—*J. econ. Ent.* **53** no. 2 pp. 322–323, 1 fig. Menasha, Wis., 1960.

Laboratory observations in Hawaii showed that when *Phenacoccus solani* Ferris was placed on pineapple plants, its feeding tracks almost invariably ended in mesophyll cells. Toxic effects of feeding were visible 7–10 days after a single insect had been allowed to feed, a white streak being the most clearly marked symptom. The capacity to induce streaking was shown to be inherent in the insect, and all plants were susceptible to it, but recovered when the insects were removed. The mealybug has not been recorded from pineapple in the field, and little is known of its occurrence in Hawaii.

Benschoter (C. A.). **Susceptibility of life stages of the Mexican fruit fly to fumigation with ethylene chlorobromide.**—*J. econ. Ent.* **53** no. 2 pp. 323–325, 2 figs., 1 ref. Menasha, Wis., 1960.

In the experiments described, naked eggs, larvae and pupae of *Anastrepha ludens* (Lw.) were fumigated with ethylene chlorobromide (1-bromo-2-chloroethane) [*cf. R.A.E.*, A **40** 74] as a preliminary to tests with infested fruit in Mexico. They were treated at 73·5–78°F. with dosages of 0·25–3,

0·063–1·5 and 0·5–8 oz. per 1,000 cu. ft., respectively, for two hours, after five minutes had been allowed for volatilisation of the liquid. For comparative purposes, adults were similarly treated with 0·125–1·5 oz. Graphical treatment of the results showed that the eggs were less susceptible to increased dosage than the other stages, so that the order of susceptibility varied at different mortality levels. At the LD99, the larvae were the most susceptible, followed in order by the adult, egg and pupa.

McIntyre (T.). **Natural factors control the pine tortoise scale in the northeast.**—*J. econ. Ent.* **53** no. 2 p. 325, 1 ref. Menasha, Wis., 1960.

Toumeyella numismatica (Pettit & McDaniel) became numerous on isolated stands of Virginia pine [*Pinus virginiana*] and some Scots pine [*P. sylvestris*] in Maryland, Pennsylvania and West Virginia in 1957 [*cf. R.A.E.*, A **47** 28]. Investigations in Maryland showed that the scale had two generations a year; overwintering females matured in spring and those of the summer generation by mid-July, and crawlers were abundant from about 8th to 15th May and again in late July. Spraying a heavily infested stand with 1 lb. malathion in 2 U.S. gal. fuel oil per acre gave excellent control of crawlers of the first generation, but those that emerged a week after treatment were unaffected. Later in the year, all the outbreaks were almost completely eliminated by two Coccinellids, *Hyperaspis binotata* (Say) and *H. signata* (Ol.), and the larvae of a predacious Pyralid, *Laetilia coccidivora* (Comst.); no further outbreaks were reported in 1958.

Beards (G. W.) & Leigh (T. F.). **A laboratory rearing method for** *Lygus hesperus* **Knight.**—*J. econ. Ent.* **53** no. 2 pp. 327–328, 3 refs. Menasha, Wis., 1960.

In the rearing method described, field-collected adults of *Lygus hesperus* Knight were put in wide-mouthed jars with fresh beans (*Phaseolus vulgaris*), which were renewed daily; there were 60–80 adults per jar, and one pod was supplied for every ten insects. The preoviposition period lasted 10–13 days, and eggs were laid over about two weeks. Pods bearing eggs were put in separate jars, and the egg and nymphal stages and complete life-cycle lasted about 7, 16 and 32–41 days, respectively. One pod could accommodate 100 young or 10 older nymphs or adults and provided food for about three days for the young and two days for the older nymphs. At 78–80°F. and 40–60 per cent. relative humidity, there was relatively little mortality.

Preliminary tests with DDT showed no significant changes in susceptibility in the first 12 generations reared.

Wright (C. G.). **A technique useful in comparing powder-post beetle populations in the substructures of buildings.**—*J. econ. Ent.* **53** no. 2 pp. 329–330, 1 fig. Menasha, Wis., 1960.

A method was developed for comparing the populations of *Xyletinus peltatus* (Harris) in the subflooring and joists of houses by means of counts of the piles of powder caused by the larvae boring in the wood. Eight rectangular areas of about 100 sq. ft. under exposed infested wood were selected in each of three houses in North Carolina and covered with felt paper, and the piles of powder that formed on this were counted and removed periodically. Counts at intervals of a week proved satisfactory.

Pigatti (A.), Figueiredo (M. B.) & Orlando (A.). **Experiências de laboratório sôbre a atividade de novos inseticidas contra o mandarová da mandióca.** [Laboratory tests of the activity of new insecticides against *Erinnyis ello*.]—*Biológico* **26** no. 3 pp. 47–51, 12 refs. São Paulo, 1960. (With a summary in English.)

In laboratory tests in Brazil in which larvae of *Erinnyis ello* (L.) were dusted with various insecticides, 1·5 per cent. endrin and 10 per cent. Sevin gave 90 and 80 per cent. mortality, respectively, in 72 hours, and the others were either much less effective or completely ineffective. Thuricide (a dust prepared from the spores of *Bacillus thuringiensis*) had very little effect.

Flores (E.), Silberschmidt (K.) & Kramer (M.). **Observações de " clorose infecciosa " das malváceas em tomateiros do campo.** [Observations on infectious chlorosis of Malvaceae in tomatos in the field.]—*Biológico* **26** no. 4 pp. 65–69, 4 figs., 3 refs. São Paulo, 1960. (With a summary in English.)

Tomato plants in a field in São Paulo were found showing symptoms of a virus disease similar to that known as infectious chlorosis in malvaceous and other plants [*cf. R.A.E.*, A **44** 277]. In tests, the infection was transmitted to tomato, tobacco and *Cyphomandra betacea* by grafting and to tomato and *Sida rhombifolia* by the feeding of *Bemisia tabaci* (Gennadius). These results are considered to confirm the identification of the virus.

Bennett (S. H.). **A preliminary note on the leaf hoppers occurring on apples at Long Ashton.**—*Rep. agric. hort. Res. Sta. Bristol 1958* pp. 139–141, 2 graphs. Long Ashton [1959].

Investigations in south-western England in 1958 showed that only four species of leafhoppers occurred on apple. In order of prevalence these were *Erythroneura alneti* (Dhlb.), *Typhlocyba froggatti* Baker, *T. debilis* Dgl. and *T. rosae* (L.). The first normally infests alder and elm, and was not previously known to develop on apple. Young nymphs were found on this tree early in the season, and the life-cycle was completed on it; there was one generation a year.

Mapother (H. R.) & Tapscott (A. R.). **Spray application problems: L. The use of fluorescent materials as tracers in spray liquids: experiments with abaca** (*Musa textilis*, **Nee**).—*Rep. agric. hort. Res. Sta. Bristol 1958* pp. 142–146, 2 pls., 6 refs. Long Ashton [1959].

Experiments are described from which it is concluded that the use of fluorescent materials affords a rapid and simple method of determining the type and degree of deposits on foliage given by sprays, though it is not quantitative. It was used with success to investigate the spray cover afforded by different types of equipment on abacá (*Musa textilis*) in North Borneo, where this plant is affected by bunchy top, a virus disease transmitted by *Pentalonia nigronervosa* Coquerel, and control measures are required. In comparative tests, emulsion sprays of 0·1 per cent. malathion or 0·05 per cent. endrin gave complete initial kill of the aphid, as compared with 80 per cent. mortality for 0·0325 per cent. wettable γ BHC. Malathion is now used, instead of γ BHC.

Anglade (P.). **Comparaison des méthodes de traitements du sol "complets" et "localisés" contre les larves d'elatérides nuisibles au maïs.** —*Phytiat.-Phytopharm.* **8** no. 1 pp. 9–16, 2 refs. Paris, 1959.

In further investigations on the control of wireworms (*Agriotes* spp.) attacking maize in south-western France [*cf. R.A.E.*, A **47** 491], complete soil treatment with a 5 per cent. aldrin dust at 2·7 or 5·4 lb. aldrin per acre a month before sowing was compared with row treatment with 1 and 2 per cent. dusts at 0·99 and 1·98 lb. aldrin per acre at sowing time. Complete treatment resulted in lower wireworm populations and a better plant stand than did row treatment, but soil conditions did not always permit this to be reflected in increased yield. The greatest reduction in population was given by complete treatment at the higher rate; for row treatment, which gave the least reduction, there was no difference between rates.

Anglade (P.). **Essai contre les larves d'elatérides de granulés de son à l'heptachlore utilisés sur la ligne de semis du maïs.**—*Phytiat.-Phytopharm.* **8** no. 1 pp. 17–21, 2 refs. Paris, 1959.

In an experiment in south-western France, furrow treatment at sowing time with bran granules containing 1 or 2 per cent. heptachlor at a rate of about 4 oz. granules per 15 yd. apparently protected maize from attack by wireworms (*Agriotes* spp.), since it increased the yield in a heavily infested field.

Schvester (D.). **Essais de traitements sur haricots contre la mouche des semis** *Hylemyia cilicrura* **Rond. (3e note).**—*Phytiat.-Phytopharm.* **8** no. 1 pp. 23–26. Paris, 1959.

In further tests in France in 1958 on seed treatments for the protection of bean seedlings from *Hylemyia cilicrura* (Rond.) [*cf. R.A.E.*, A **47** 489], better results were given by treating the seeds with a mixture of γ BHC (lindane) and thiram, with methylcellulose as an adhesive, in the previous year than just before sowing, and this method was also superior to seed treatment with the mixed powder alone or followed by moistening with water.

Féron (M.), Guennelon (G.) & Audemard (H.). **Technique de traitement contre la cécidomyie des lavandes** (*Thomasiniana lavandulae* **Barnes**) **et résultats obtenus.**—*Phytiat.-Phytopharm.* **8** no. 1 pp. 27–31, 2 figs., 1 ref. Paris, 1959.

An account is given of tests in south-western France in 1958 showing that repeated dusting with 10 per cent. DDT at the time of adult emergence reduced attack by *Thomasiniana lavandulae* Barnes from 63 to 5 per cent. on true lavender [*Lavandula vera*] and from 53 to 8 per cent. on hybrids of it [*cf. R.A.E.*, A **48** 340]. A device for applying the dust to the interior of the bushes is described.

Desmoras (J.). **Activités insecticides de composés organophosphores sur les larves de** *Ceratitis capitata* **W. Application au dosage biologique de l'endothion.**—*Phytiat.-Phytopharm.* **8** no. 2 pp. 73–83, 5 refs. Paris, 1959.

The development of a technique for rearing *Ceratitis capitata* (Wied.) in the laboratory [*cf. R.A.E.*, A **48** 81, etc.] allowed phosphorus insecticides to

be tested against larvae two days old by incorporation in the carrot medium used as their food. The order of decreasing effectiveness was parathion, endothion, malathion, diazinon, trichlorphon (Dipterex), phosphamidon and methyl-demeton (Metasystox). A method is described in which the larvae are used for the bioassay of residues of endothion in fruits.

Hurpin (B.). **Les maladies du ver blanc** (*Melolontha melolontha* **L.**) **et essai d'utilisation d'une maladie laiteuse indigène.**—*Phytiat.-Phytopharm.* **8** no. 2 pp. 85–90, 1 pl., 12 refs. Paris, 1959.

The author reviews the diseases to which the larvae of *Melolontha melolontha* (L.) are subject and investigations on the bacillus that causes milky disease of them in France [*cf. R.A.E.*, A **49** 93, etc.] and states that plot tests on the use of the latter in the field were begun in 1958 in Sarthe.

Baker (E. W.) & Pritchard (A. E.). **The Tetranychoid mites of Africa.**—*Hilgardia* **29** no. 11 pp. 455–574, 103 figs., 3 pp. refs. Berkeley, Cal., 1960.

This work is based largely on field collections by the senior author in Africa, particularly in the Belgian Congo, and a survey in Mauritius by L. A. Moutia [*R.A.E.*, A **46** 167]. In it, 48 species of Tetranychids, of which 30 are described as new, two Tuckerellids, and 21 Tenuipalpids, of which two are new, are recognised, and keys to them are given, together with information on synonymy, corrections of earlier misidentifications, and notes on distribution and food-plants. As regards species mentioned in this *Review*, it is noted that *Bryobia arborea* Morgan & Anderson, a name that was proposed for a member of the complex of *B. praetiosa* Koch on fruit trees in Canada [**47** 118], is a synonym of *B. rubrioculus* (Scheuten); this species was collected on apple in the Western Cape Province of South Africa in the summer of 1950–51. *Anychus ricini* Rahman & Sapra [**29** 271] is a synonym of *Eutetranychus orientalis* (Klein), which was found on frangipani [*Plumeria*] in South Africa and also occurs in the Sudan and Asiatic countries. Records of *Oligonychus simplex* (Banks) in Iraq by Buxton [**9** 91] and in Algeria by André [**21** 181, etc.] refer to *O. afrasiaticus* (McG.), which is recorded from dates in the Sudan. Of the species recorded from Mauritius by Moutia [**46** 167], *Eutetranychus banksi* (McG.) is a misidentification for *E. africanus* (Tucker), which is not, as considered in a previous work by the authors [**44** 19], a synonym of *E. banksi*; *Oligonychus* sp. is a mixture of two new species described as *O. tylus* (on *Panicum maximum*) and *O. plegas* (on coconut); *Tetranychus* sp. (on beans and other plants) is described as *T. macfarlanei*, sp.n.; *T. cucurbitae* Rahman & Sapra is a misidentification for *T. neocaledonicus* André; and the species referred to as *T. marianae* McG. is a new species, described as *T. evansi*, sp.n. *Petrobia cepae*, *Paratetranychus terminalis* and *T. cucurbitacearum*, described by Taher Sayed from Egypt [**36** 411], are synonyms of *Petrobia latens* (Müller), *O. coffeae* (Nietn.) and *T. cinnabarinus* (Boisd.) [*cf.* **46** 261], respectively; the first is recorded from wheat in Southern Rhodesia, the second on various plants in Kenya, the Belgium Congo, South Africa and Mauritius, and the third from cotton in Uganda, leek and *Lathyrus odoratus* in Kenya, and other plants in the Belgian Congo and South Africa. The true *T. telarius* (L.) [*cf.* **46** 261] is recorded from the Sudan and the Belgian Congo; its presence in South Africa [*cf.* **45** 371; **48** 557] is unconfirmed, since females seen from apple in the Transvaal represent the non-feeding phase [*cf.* **44** 20].

Eastop (V. F.). **A study of the Aphididae (Homoptera) of West Africa.**—$9\frac{3}{4} \times 6$ in., vi + 93 pp., 56 figs., $4\frac{1}{2}$ pp. refs. London, Brit. Mus. (Nat. Hist.), 1961. Price £1 5*s*.

This work is based on collections made between March 1956 and August 1957 in the British Cameroons, Nigeria, Ghana, Sierra Leone and the Gambia, parts of Africa from which few aphids were previously known. In it, the author records 56 species that were seen and gives keys for the identification of these and of a few others which, because of their cosmopolitan distribution, are likely to occur in West Africa, followed by short descriptions and information on food-plants, geographical distribution, and, where appropriate, importance in the transmission of plant viruses. A list of the plants showing the species that attack them and a few corrections and additions to the author's similar work on the aphids of East Africa [*R.A.E.*, A **46** 213] are included.

Annual report of the West African Cocoa Research Institute 1957–58.—77 [+2] pp., frontis., 1 map, 4 graphs. Tafo, 1959. **1958–59.**—87 [+3] pp., frontis., 1 map, 3 figs. 1960.

Work on pests and diseases of cacao in Ghana and Nigeria during 1957–58 and 1958–59 is reviewed as in previous years [*cf. R.A.E.*, A **46** 210].

During continued experiments in Ghana on the control of mealybug vectors of the swollen-shoot virus disease by destroying their attendant ants [*cf.* **46** 211], which are described by P. F. Entwistle in the first report, a dieldrin mist spray applied to the whole tree at a concentration of 1 lb. in 22 gal. and a rate of 24 gal. per acre to cacao over an area of 200 acres in March–April 1957, about three months after a previous application, reduced ant populations for over a year, the minimum being reached after two months, and populations of *Planococcoides* (*Pseudococcus*) *njalensis* (Laing) by a minimum of 90 per cent. for a year; 18 months after treatment, however, the incidence of swollen-shoot was still unaffected. In the second report, Entwistle states that a second double treatment with dieldrin at 1 lb. in 20 gal. water per acre, applied to the trunks only, in June–July and August–September 1958 reduced the ants more than the previous one and virtually eliminated *P. njalensis* until the end of March 1959. Virus incidence fell to 58 per cent. of the pre-treatment level where trees visibly affected with virus were felled each month and to 29 per cent. where trees in contact with the affected ones were also removed. The results of similar experiments on smaller areas are given in the first report. Double applications, in December 1956 and February 1957, to 76 scattered outbreaks 2–4 acres in area were unsatisfactory against the ants, reduced numbers of mealybugs and infested trees only temporarily, and had no apparent effect on virus incidence. A single application over an area of 1 sq. mile in February 1957 gave only temporary control. Malathion applied as a canopy spray at 4 oz. in 20 gal. water per acre against surviving examples of *P. njalensis* and the few mealybugs of other species less closely associated with ants had no apparent effect.

C. G. Johnson & Entwistle state that in work on the control of Mirids [*Sahlbergella singularis* Hagl. and *Distantiella theobroma* (Dist.)] on 100-acre plots in Ghana in 1957–58, two applications of endrin, dieldrin and aldrin at 4 oz. toxicant in 5 gal. water per acre [*cf.* **46** 211] were made a month apart and followed six months later by another two at 1 oz. toxicant. Endrin gave good results and was superior to aldrin, but dieldrin was ineffective in the first two applications and was replaced in the last two by γ BHC at 2 oz. toxicant, which gave good control; malathion was ineffective in small-scale tests. In summarising the results of field trials over two seasons in the

second report, Johnson states that, of the five materials tested, dieldrin is unsuitable because its use involves risk of increased damage by *Marmara* sp., malathion was unsatisfactory at economic rates and endrin was outstandingly effective; at doses similar to those for endrin, aldrin was slightly, but consistently, less effective than γ BHC (Gammalin), and is considered suitable if used at 2 oz. per acre for the second treatment.

Johnson & Entwistle report on work in 1957–58 on the incidence of *Marmara* sp., which mines beneath the epidermis of green pods and unhardened fans and chupons, causing large pieces of epidermis to peel off, and became very abundant in the main crop. The damage to the pods is of no economic importance, though it sometimes hinders assessment of ripeness, and that to the fans and chupons often passes unnoticed, but apart from the potential economic importance of the moth, its presence is considered likely to prejudice farmers against measures for controlling Mirids. The pods were most severely mined where dieldrin and BHC sprays had been applied against ants and mealybugs, and the amount of damage to pods and fans in unsprayed plots was related to their distance from sprayed ones, which exerted a strong effect at distances of up to 300 ft. In preliminary small-scale experiments described by Entwistle, emulsion sprays of parathion at 0·01 per cent. gave good control of the larvae on pods and chupons. In the second report, Entwistle states that parasitism in peak populations of *Marmara* is of the order of 60 per cent.; most of it is due to *Ageniaspis* sp., up to 24 larvae of which were found in one host larva, and an external parasite, *Bracon* sp., which caused only 2–3 per cent. parasitism.

Entwistle reports on other minor pests in both years. Scolytids, which are frequent secondary pests at Tafo, usually occurring in the fans or chupons, were reported in 1957–58 to prevent the establishment of cacao seedlings in Sierra Leone, and similar damage had previously been reported from the Ivory Coast. In the second report, *Xyleborus morstatti* Hag. is stated to be the principal species responsible, though *Hypothenemus mozambiquensis* Egg., a species of *Hypothenemus* tentatively identified as *H. pusillus* Egg., and an unidentified species were also concerned. Seven Scolytids, not including *X. morstatti*, and a Platypodid found during 1958–59 in Ghana on cacao trees damaged by a root fungus or by lightning are listed. *X. morstatti* appears to be the principal species attacking cacao throughout West Africa, but healthy plants are probably not susceptible; primary Scolytid attack appears to be least common in Ghana, and damage to seedlings is of little importance there [*cf.* **40** 365]. Taxonomic studies on *Tragocephala* spp. attacking cacao in West Africa, given in the second report, showed that several of the 36 described varieties of *T. nobilis* (F.), including *castnia* Thoms., *gorilla* Thoms. and *chloris* Chevr. (which is not definitely known to attack cacao) [*cf.* **44** 309], represent distinct species. *T. castnia* is the principal species on cacao in Ghana, where it is widespread; characters are given distinguishing it from *T. gorilla*, with which it has been confused and which is not known on cacao in Ghana, though it is the principal species on this crop in Nigeria. *T. castnia* and *T. nobilis* occur in the Ivory Coast, and *T. nobilis* also at Tafo and in the Belgian Congo, though in the latter it was not definitely associated with cacao. The egg, larval and pupal stages of *T. castnia* lasted 9–13, 70–125 and 19–28 days, respectively, in the laboratory; the adults remained in the pupal cells for 8–18 days and survived for 10–207 days, and the females began to oviposit 2–30 days after mating. Observations on this Lamiid described in the first report show that it principally attacks the chupons and occasionally the fans of cacao. The females ring the bark 2–10 in. below the apical bud and embed their eggs in the tissues about ½ in. above the ring. The larvae feed first in the dead or dying tissue above the ring and later in the living wood below it. Seedlings without fan

branches die or are severely damaged in consequence and in those with fan branches all the tissues above the jorquette die; damage may extend as far as 24 in. below the oviposition site. The Cossid, *Eulophonotus myrmeleon* Fldr., which has several times been reported attacking the main trunks of mature cacao at Tafo, was observed, for the first time, attacking the tap-root of a young bearing tree during 1957–58.

Work in 1958–59 on fumigation for the control of mealybugs on cacao pods exported for seed is described by K. B. Armstrong. Sacks about 5 cu. ft. in size with polythene linings were filled with about 170 pods, of which three were artificially infested with mealybugs, a cloth soaked in a 1:1 mixture of ethylene dichloride and carbon tetrachloride at rates of 1–9 oz. per sack was introduced and the sacks were tied and sealed. All rates gave complete mortality in 48 hours, and rates of up to 6 oz. did not reduce germination.

Work in Nigeria on Mirids, mealybugs and other insect pests of cacao during the two years is reported by R. G. Donald. A comparison of the yields from trees sprayed with BHC against Mirids [*cf.* **46** 412] from July 1956 to June 1957, when average production reached a record figure, and July–December 1957, when it was low, showed that yields from trees that had lost at least half their canopy were considerably higher during the latter period, whereas those from trees that had lost a quarter of the canopy decreased slightly and those from trees with more or less complete canopies decreased by almost half. In a normal season, Mirid control should result in an increase of 2½–3 pods per tree; since the crop in 1957–58 was expected to be only 60–70 per cent. of that of the previous year, all trees with damaged crowns had benefited from the treatment.

In work on mealybugs in 1957–58 in two adjoining plots, one overgrown with tall weeds and the other without weeds, ants of the genus *Crematogaster* were not abundant except on a few trees in the overgrown plot, where they tended most colonies of *Planococcus kenyae* (Le Pelley), *P. citri* (Risso) and *Planococcoides njalensis*. Less than 10 per cent. of the colonies on all the other trees were tended by ants, and species other than *Crematogaster* were concerned in nearly half. Nine species of mealybugs were present, and all trees were infested with 2–7 of them. The commonest species in both plots were, in order of decreasing abundance, *Planococcus kenyae*, *Ferrisiana virgata* (Ckll.) and *P. citri*. *Planococcoides njalensis* was almost confined to trees on which Crematogasterine ants were numerous. *Pseudococcus concavocerarii* James was very rare on the overgrown plot but commoner in the weed-free one. The only seasonal variation was a marked increase in *F. virgata* when new leaves developed after the early rains.

Scolytid damage to first- and second-year seedlings, caused mainly by *Stephanoderes* spp., was reported from several localities during the dry season in 1957–58, and the fan-branches of four-year-old trees were attacked in one. Entry was primarily through leaf scars or withered petioles, but occasionally through an internode, and heavy infestations developed only in severely wilted seedlings. Fungi were isolated from discoloured wood round empty galleries. In experiments on control in 1958–59, a urea-formaldehyde lacquer containing 10 per cent. dieldrin and 4 per cent. aldrin applied to the lower 12 in. of the stems of seedlings in October, before or after planting out, gave only 33 per cent. control for two months, but was superior to an emulsion spray of 0·5 per cent. dieldrin applied to the whole stem or to the lower 12 in. in November and subsequently at monthly intervals. Damage was first noted in November, increased rapidly till early January, and was typical of *X. morstatti*, though most galleries were empty.

In 1957–58, *Apate monacha* F. attacked about 70 per cent. of the larger seedlings, but only one small replacement seedling, in cacao 3–4 years old over an area of about ¼ acre. The largest plants were affected most, and 19

entry holes, of which 17 were in the trunk, were found in one. Much of the shade had been removed during the previous wet season, and this may have increased susceptibility. Two other small infestations by the Bostrychid were later found in the same locality, and small seedlings in both that and another district were killed by an Anthribid and a weevil, which are stated in the second report to have been identified as *Phloeobius* sp. and *Coryssopus* sp., respectively. *Phloeobius* caused further localised but severe damage in new plantings under moderate to heavy shade in two areas in 1958–59. There is normally only one larva per seedling; it enters at ground level, moves spirally upwards or downwards for about 1–3 in. and then in the opposite direction, and finally pupates within the stem at ground level. The seedlings usually die suddenly during the last stages of larval activity.

Work in 1958–59 to determine whether the cost of spraying large areas of cacao against Mirids could be reduced by substituting a volatile solvent (kerosene) for water in mist sprays is described by J. F. Longworth. In preliminary experiments, 1 pint 20 per cent. γ BHC (Gammalin 20) in 1 gal. kerosene applied as a dense fog did not permanently or seriously harm the plants, was as penetrating as and more persistent than the water spray, and produced a considerably wider swath. In a one-acre plot of severely infested farmer's cacao with very little canopy and extensive ground vegetation to which 1 gal. spray was applied in 16-yd. swaths in October–November, the numbers of Mirid adults and nymphs were reduced from 121 and 81, respectively, before the first application to 2 and 8 after the second. The method is considered promising, provided that a cheaper solvent can be found and a smaller jet used.

D. Kay reports that surveys in the Western Region in 1957–58 showed that 25 per cent. of the areas affected by die-back on cacao branches ½ in. or more in diameter were infested by *Kalotermes* (*Neotermes*) *aburiensis* (Sjöst.). The termite colonies were initiated in dead wood, but later attacked living wood and extended into it for distances of 6–8 in.

Popov (G.). **The desert locust** (*Schistocerca gregaria* **Forskål**) **in the island of Socotra.**—*J. Anim. Ecol.* **28** no. 1 pp. 89–95, 1 pl., 3 maps (1 fldg.), 9 refs. Oxford, 1959.

Following reports of breeding by *Schistocerca gregaria* (Forsk.) on Socotra in the winter of 1952–53, a survey of the island to determine its suitability for the locust was carried out in January–April 1953. The only previous records of breeding were in December 1942 and the winter of 1950–51. Bands of hoppers in all instars were seen in one district on 25th January 1953, and eggs had probably been laid there between early December and mid-January; in another place, it was estimated that oviposition had begun in late November. Eggs were laid over most of the island, except the western part of the limestone plateau, but mainly on the coastal plain. The resulting infestation was heavy, though most bands were small. The hoppers were active for most of the day and commonly marched up the dry beds of streams, so that most moved from the coastal plains to the highlands. Fledglings were present throughout the island by early March, and the survivors from control operations formed a single swarm, covering about 6–10 sq. miles, which was present in the highlands from about 11th to 23rd March; its daily movements resembled those recorded for the species elsewhere under similar conditions. The north-east monsoon was prevalent at the time and, on leaving Socotra, the swarm probably moved towards the Somali Horn of Africa. An immature swarm reported there on 28th March resembled it in size and maturity; this swarm remained recognisable for almost a month. In Socotra, about 5 per

cent. of the young adults were parasitised by *Sarcophaga tibialis* (Macq.). Many species of birds, as well as lizards, centipedes and scorpions, preyed on the locusts, but were of less importance in control.

Since 1952–53, the only record of *S. gregaria* from Socotra is of a few adults of unknown origin observed in August–October 1956. From a consideration of charts of the seasonal breeding and migration of *S. gregaria*, it appears that the swarms known to have bred in Socotra may have originated in India; they were possibly connected with the mass movement to southern Iran, Oman and southern Arabia that occurred in those years. Pink locusts observed near and in Socotra in June 1952 probably belonged to young swarms then present in the Somali peninsula. It is not known whether the solitary phase of *S. gregaria* occurs in the island. Owing to its isolation, small size and ecological conditions, Socotra is regarded as unlikely to be of importance in the dynamics of the locust.

Ellis (P. E.). **Some factors influencing phase characters in the nymphs of the locust,** *Locusta migratoria migratorioides* **(R. and F.).**—*Insectes sociaux* **6** no. 1 pp. 21–39, 1 graph, 17 refs. Paris, 1959. (With summaries in French & German.)

The following is based on the author's summary. When nymphs of *Locusta migratoria migratorioides* (R. & F.) are reared under crowded conditions in the laboratory, they generally march well, have low F/C ratios and are generally black and orange in colour in the later instars [*cf. R.A.E.*, A **39** 190], all which characters are typical of swarm populations in the field. Nymphs reared in isolation, on the other hand, show low marching activity, high F/C ratios and are generally green or fawn in colour. Thus, their own rearing conditions profoundly affect these characters. Newly hatched nymphs vary in colour from jet black to fawn. In the work described, nymphs that were pale at hatching marched less during the first and second instars than those that were dark. However, the rearing condition rapidly became the more important factor, so that by the third instar, nymphs that were pale at hatching showed similar marching behaviour to those that were dark. The experiments showed that the rearing conditions of the preceding generations also influence the expression of phase characters in the offspring and that, in a line of locusts reared continuously in isolation, there was an accumulation of *solitaria* characters from generation to generation. The various phase characters appear to be related in a general way, but F/C ratios show a more steady cumulative effect from generation to generation than marching or colour. As regards both F/C ratios and colour, the results suggested that, during isolation, females vary towards *solitaria* more easily than males, while under conditions of crowding they retain *solitaria* morphometrics and colour longer than the males.

Popov (G. B.). **Ecological studies on oviposition by** *Locusta migratoria migratorioides* **(R. & F.) in its outbreak area in the French Sudan.**—*Locusta* no. 6 pp. 3–63, 5 pls., 6 graphs, 7 maps (1 fldg.), 43 refs. Nogent-sur-Marne, 1959. (With a summary in French.)

The following is based largely on the author's summary. The ecology of oviposition by *Locusta migratoria migratorioides* (R. & F.) was studied in the flood plain of the Niger, in the French Sudan, between 24th November 1955 and 25th March 1956, and laboratory examination of egg-pods collected in the field was continued until May 1956. The range of temperatures at

the soil surface most favourable for oviposition was 30–34°C. [86–93·2°F.]; oviposition took place at midday in warm, sheltered situations during the cold season and earlier in the day, in cooler, more exposed places, in the hot season. Most egg-pods were laid in moist soil, and compact silt soils were preferred to loose sand or hard clay. The influence of vegetation appeared to be exerted through the shelter and protection that it afforded rather than through its specific composition; small, sheltered, bare or partly bare patches were preferred. In general, the results confirmed laboratory findings [*R.A.E.*, A **46** 253].

The distribution of egg-pods was studied in relation to the progress and level of flooding and to vegetation and topography by means of transects, quadrats and timed searches. It was shown that the influence of these factors leads to unequal distribution of adults and oviposition sites, high densities of egg-pods being found habitually near the edge of the water, and that it also accounts for the annual and seasonal variations in the position of oviposition sites observed at some stations. The choice of such areas for oviposition by females in dense populations results in uneven distribution and local concentrations of egg-pods. These results are compared with those of previous work [*cf.* **38** 133; **44** 461, 462], especially as they concern the dynamics of band formation. It is concluded that local high density of egg-pods is important because it favours the aggregation of hoppers, but that the formation of hopper bands also depends on the size of the parent population and, especially, on the number of females that oviposit at the same site over a short period, so that the hatching of the eggs is synchronised. When sufficient hoppers hatch and remain together for 3–4 days, they become conditioned to crowding [*cf.* **43** 297] and able to form bands.

The fecundity of the females and mortality of the eggs are also important in determining population density and gregariousness. The number of eggs per pod in 158 egg-pods varied from 24 to 105, and the mean number per pod at each of five stations from 50 to 72. The earliest pods to be laid contained the fewest eggs. Circumstantial evidence indicated that the females probably do not lay more than two egg-pods each. Embryonic development lasted 21–33 days and was slowest during the cool weather of December–January and most rapid during the warmer weather of February–March. Eggs laid in dry soil tended to develop faster than those in moist, probably because the temperature was higher in the former. Within limits, this favours synchronised hatching, since the last eggs to be laid were in the driest situations.

Embryonic diapause sometimes occurred, and one batch of eggs did not hatch until 102 days after deposition. Arrested development seemed to be associated with insufficient moisture, but not with complete desiccation, which caused total mortality. However, the occasional presence of a few underdeveloped eggs among normal ones in an egg-pod indicated a hereditary factor. In experiments in which eggs were submerged under water for a few days, recently laid ones were killed, whereas those that had reached the stage of blastokinesis but were in diapause subsequently developed normally, though they failed to hatch. Flooding for more than 30 days is probably fatal. Mortality in the egg stage was due principally to predators and, to a less extent, parasites, and relatively little was attributable to environmental conditions or lack of viability. The chief predators were Carabids, especially species of the genus *Chlaenius*, and *C.* (*Homalolachnus*) *sexmaculatus* Dej. was associated with more than half the egg-pods attacked by them. Predators caused about 40 per cent. mortality, and parasites an average of 13·5 per cent., but the predators attacked parasitised eggs, so that the combined mortality was only 44 per cent. *Scelio sudanensis* Ferrière was responsible for 95 per cent. of the parasitism, and *S. remaudierei* Ferrière for the remainder. Natural enemies appear to be of great importance in the flood

plain, but their seasonal and annual fluctuations are not known. Egg survival, based on the number of healthy eggs found, sometimes a long time before hatching, in the egg-pods, amounted to 55 per cent. This figure does not take into account the mortality possible during the whole stage or at hatching; the latter was estimated in several cases at 2 per cent., and total mortality in the egg stage was probably well above 50 per cent.

Dirsh (V. M.). **The early stages of** *Gastrimargus nigericus* **Uvarov 1926 (Acridoidea, Orthoptera).**—*Locusta* no. 6 pp. 65–72, 20 figs. Nogent-sur-Marne, 1959. (With a summary in French.)

Adults of the grasshopper, *Gastrimargus nigericus* Uvarov, greatly resemble adults of *Locusta migratoria migratorioides* (R. & F.) phase *solitaria*, with which they often occur, but the first-instar nymphs are readily distinguishable. Descriptions are given of the egg-pod and all stages of *G. nigericus*, based on the progeny of adults received from Nigeria, together with characters and figures distinguishing each from the corresponding stage of *L. m. migratorioides*.

Chin (Chun-teh), Quo (Fu), Chai (Chi-hui) & Sha (Cha-yun). **Studies on the locust egg. IV. The survival and embryonic development of the locust egg under water.** [*In Chinese.*]—*Acta ent. sin.* **9** no. 4 pp. 287–305, 7 figs., 7 refs. [Peking] 1959. (With a summary in English.)

In China, *Locusta migratoria manilensis* (Meyen) breeds in drained river beds and lowlands adjacent to lakes and coasts, and the eggs are subject to flooding. In this part of a series [*cf. R.A.E.*, A **48** 408], laboratory experiments on the effects of immersion are described. It was found that development proceeded, provided that the temperatures remained suitable, and mortality was lower in the middle than in the early and late stages of embryonic development. The factors responsible for this are discussed.

Li (Be-hua). **Preliminary study on the life history of the oil pine caterpillar (*Dendrolimus spectabilis* Butl.) in Shantung Province.** [*In Chinese.*]—*Acta ent. sin.* **9** no. 4 pp. 316–324, 2 figs., 5 refs. [Peking] 1959. (With a summary in English.)

In Shantung, *Dendrolimus spectabilis* (Btlr.) occurs mainly in the Jiaotung peninsula and the south-central district and attacks various species of pines. It has one generation a year. The adults emerge in July and August and live for about a week, and the females lay up to 950 eggs each, mostly during the night after pairing. The larvae leave the trees in autumn and hibernate under débris on the ground, re-ascending the trunks in spring when the average temperature rises above 10°C. [50°F.]. Pupation occurs in the tops of the trees, or sometimes on the trunks or on shrubs. The eggs are parasitised by *Anastatus* sp. and *Trichogramma* sp., the larvae by *Apanteles* sp. and *Campoplegidea* (*Campoplex*) *proxima* (Först.), and the pupae by unidentified Diptera.

Wei (Hung-chuen). **Effectiveness of insecticidal dusts for the control of Chinese army worm (*Pseudaletia separata* (Walker)).** [*In Chinese.*]—*Acta ent. sin.* **9** no. 4 pp. 325–335, 1 fig., 15 refs. [Peking] 1959. (With a summary in English.)

Pseudaletia separata (Wlk.) is a widely distributed pest of field crops in China. In tests of insecticides for use against it in 1956–57, the best control of the larvae was given by a 1:1 or 1:2 dust mixture of 5 per cent. DDT and 0·5 per cent. γ BHC, applied at the rate of 20·25 lb. per acre, which was much better than either material used alone and than toxaphene, alone or with BHC.

Peng (Chien-wen). **Preliminary observations on the life history and habits of *Lebeda nobilis* Walker a pest on camellia oleose in Hunan.** [*In Chinese.*]—*Acta ent. sin.* **9** no. 4 pp. 336–341, 6 figs. [Peking] 1959. (With a summary in English.)

Lebeda nobilis Wlk., all stages of which are described, feeds on various trees and damages *Camellia oleifera* (*oleosa*) in Hunan and Kiangsi, China. It has one generation a year and overwinters in the egg. The egg stage averages 166·5 days and the larval, prepupal and pupal stages 137, 7·5 and 25·8 days, respectively; the adults survive for 52·5 days.

Bardner (R.). **Effect of formulation on toxicity to plants and insects of some systemic insecticidal seed dressings.**—*J. Sci. Fd Agric.* **11** no. 12 pp. 736–744, 14 refs. London, 1960.

The following is based on the author's summary of this account of experiments carried out in the greenhouse in Britain. Wheat, white mustard (*Sinapis alba*) and sugar-beet seeds were treated with dressings containing certain systemic insecticides and various adhesives and fillers. Activated carbon, polyvinyl-acetate emulsion and a chlorinated diphenyl resin lessened the toxicity of the insecticides to seedlings of all three plants growing in sand. Polyethylene glycol ethers and polyvinyl alcohol solution also had some effect. Carbon and polyvinyl acetate prolonged the period of systemic action of phorate (Thimet) against *Phaedon cochleariae* (F.) on mustard and *Rhopalosiphum padi* (L.) on wheat. Mustard plants grown from seeds treated with γ BHC formulated with these materials were slow to attain their maximum insecticidal activity. These effects are attributed to the initial absorption of insecticide by the sticker or filler and its subsequent slow release. Formulations permitting the slow release of insecticides have a practical use because they can combine low phytotoxicity with a long persistence of systemic insecticidal activity.

Dyte (C. E.) & Tyler (P. S.). **The contamination of flour by insecticidal lacquers containing endrin and dieldrin.**—*J. Sci. Fd Agric.* **11** no. 12 pp. 745–750, 4 graphs, 18 refs. London, 1960.

Lacquers (or resins) incorporating insecticides are useful against crawling insect pests, and are being used in flour mills in Britain. The tests described were carried out to ascertain whether there is a danger of their contaminating flour residues, and the following is virtually the authors' summary of the results.

Insecticidal lacquers containing dieldrin emit a toxic vapour, which passes through jute sacking and kraft paper and is readily absorbed by flour. Dieldrin contamination can persist in flour stored in open-topped containers for 18 months, and can be produced by as little as 3 hours' contact with the lacquer. Samples of flour that had been in contact with an endrin lacquer

in one flour mill contained up to 323 parts endrin per million, which is more than twice the concentration (150 p.p.m.) known to cause symptoms of acute poisoning in man.

Cornwell (P. B.) & Bull (J. O.). **Insect control by gamma-irradiation: an appraisal of the potentialities and problems involved.**—*J. Sci. Fd Agric.* **11** no. 12 pp. 754–768, 9 figs., 22 refs. London, 1960.

The authors discuss the range of radioisotopes available for use as sources of γ-radiation, the mode of action of such radiation on insects and two ways in which it can be used for insect control. The first of these is indirect control by the release of sterilised adults. This method proved successful in one case [*cf. R.A.E.*, B **44** 104], but appeared to offer no advantages for use against *Anagasta kühniella* (Zell.) in flour mills. The second is the direct control of insects in stored products [*cf.* A **45** 390]. For this purpose, it would most economically be applied to products handled in bulk at particular centres, but it must be followed by storage under insect-proof conditions. Radioactive cobalt (^{60}Co) has been used in recent years for testing the susceptibility of insect pests to irradiation, and the effect on *Sitophilus granarius* (L.) and *S. oryzae* (L.) in grain was studied in detail. The results of these tests and of earlier ones with these and other Coleopterous pests of stored grain showed that killing the adults in less than 24 hours required doses almost high enough to affect the flavour and odour of the product. Treatment with about 20,000 rep sterilised the adults and killed them in 2–5 weeks, but the larvae showed prolonged survival and higher doses than those for adults were necessary to produce death in comparable periods; some feeding continued during the period of survival. A dose of 2,000 rep was the lowest causing any mortality of adults of *S. granarius*, and it reduced the production of young by 50 per cent., whereas 6,000 rep reduced survival and reproduction by about 90 and 99 per cent., respectively, 10,000 rep gave almost complete kill in 10–15 days and more than 99·9 per cent. reduction in fertility and 15,000 rep caused complete sterility. Resistance to radiation increased gradually during the life-cycle; eggs and larvae failed to reach maturity when treated with more than 5,000 rep, whereas 20 per cent. of the pupae transformed to adults after treatment with 20,000 rep; all stages could be sterilised by doses of 15,000 rep, and 16,500 was adequate for the treatment of large populations. Immature stages, which are destroyed by very low doses of radiation, are often the most difficult to combat by chemical means.

The problems of applying radiation treatments for disinfestation are discussed. No resistance to irradiation has been discovered, but the possibility of its development must be considered in the evaluation of doses for commercial treatment. This evaluation is complicated by the fact that if fertile insects are greatly outnumbered by sterile ones after treatment with substerilising doses, many intermatings will be infertile and control will therefore be more complete than expected. Biological material tends to recover from sublethal doses of whole-body irradiation, and tests with *S. granarius* showed that repeated small doses of radiation may be much less effective than a single large one, the reduction depending on the interval between treatments and the degree of damage caused by the fractionated dose. Irradiation plant should therefore be of sufficient capacity to make multiple treatments unnecessary, and preliminary tests are necessary to show that irradiation produces no adverse effect on the quality of the product. Practical problems of the design and cost of installations for the treatment of grain are discussed in some detail, and the relative merits of fumigation and irradiation are compared. As the only advantages of irradiation may be that it can give

complete control of grain pests and that safety systems are well advanced and adequate, it seems unlikely that it will be adopted commercially for some time. Problems in the practical treatment of other products are noted.

ZAHER (M. A.) & LONG (D. B.). **Some effects of larval population density on the biology of** *Pieris brassicae* **L. and** *Plusia gamma* **L.**—*Proc. R. ent. Soc. Lond.* (A) **34** pt. 7–9 pp. 97–109, 5 figs., 13 refs. London, 1959.

The following is substantially the authors' summary. A laboratory study of some of the biological effects of larval population density in Lepidoptera [*cf. R.A.E.*, A **47** 484] showed that in *Autographa* (*Plusia*) *gamma* (L.) crowding prolonged the pupal period but shortened the larval and pre oviposition periods so much that total development from hatching to oviposition was shorter than under solitary conditions. Under both conditions, a long larval period was followed by a relatively short pupal period, and a short preoviposition period by the laying of large numbers of eggs. The fecundity of the females was greater when they had been reared in crowded cultures, though under both conditions of culture more than half the eggs were laid by slightly more than 20 per cent. of the females. In *Pieris brassicae* (L.), the shorter larval period in crowded cultures was followed by a shorter pupal but a longer preoviposition period, and total development was, as in *A. gamma*, shorter under crowded than under solitary conditions. The fecundity of the females was, however, lower, with fewer eggs per cluster, under crowded conditions. In both species, the mean egg weight was lower in crowded cultures. There was a tendency for the survival period of adult males of *A. gamma* and adult females of *P. brassicae* to be longer when they were reared in crowded cultures. Larval crowding in *A. gamma* did not influence either the percentage of sterile females or their survival.

ALKAN (B.). **Trabzon hububat silosunda bulunan Türkiye için yeni bir böcek türü** *Troctes entomophilus* **Enderlein.** [*T. entomophilus*, a species of insect new to Turkey found in grain silos at Trebizond.]—*Koruma* **2** no. 8 pp. 4–5, 6 refs. [Istanbul] 1961.

Troctes (*Liposcelis*) *entomophilus* End. was found in Turkey for the first time in October 1959, when it was very numerous in grain silos at Trebizond. There is little doubt that, under favourable conditions, this Liposcelid injures grain.

GÖKSU (M. E.). **Yurdumuzda yeni görülen bir kirmızı örümcek türü** *Metatetranychus ulmi* **Koch. (syn:** *Paratetranychus pilosus* **C. ve F.).** [A new species of red spider in our country, *Panonychus ulmi.*]—*Koruma* **2** no. 10 pp. 4–5. Istanbul, 1961. (With a summary in English.)

Panonychus (*Metatetranychus*) *ulmi* (Koch) had not been found in Turkey until the summer of 1960, when it was observed near Istanbul. Early in 1961, winter eggs were seen on apple and pear in several localities. The mites and their eggs are briefly described, characters differentiating the species from other Tetranychids present are noted and control measures are reviewed. *Scymnus* (*Stethorus*) *punctillum* Weise, which preys on *P. ulmi*, occurs in

the infested area. The mite is thought to have been introduced with plant material from Italy.

Varma (P. M.) & Capoor (S. P.). **Mosaic disease of cardamom and its transmission by the banana aphid** *Pentalonia nigronervosa* **Coq.**—*Indian J. agric. Sci.* **28** (1958) pt. 1 pp. 97–107, 3 figs., 11 refs. New Delhi, 1959.

The following is based largely on the authors' summary. Cardamom (*Elettaria cardamomum*) grown in Bombay State suffers from a mosaic disease, the symptoms of which are irregular chlorotic streaks running from the midrib towards the periphery of the leaf lamina. The disease renders plantations commercially useless within three years. In tests, the virus could not be transmitted by mechanical means or by *Taeniothrips cardamomi* Ram. Ayyar, *Erythroneura* sp. or *Bemisia* sp., but it was transmitted in the non-persistent manner by *Pentalonia nigronervosa* Coquerel. All these insects occur on cardamom in the field, but *P. nigronervosa*, which breeds throughout the year on banana, is common on it only in July–February; it prefers plants damaged by *Dichocrocis punctiferalis* (Gn.).

Chona (B. L.) & Seth (M. L.). *Aphis maidis* **Fitch as vector of sugarcane mosaic in India.**—*Indian J. agric. Sci.* **28** (1958) pt. 2 pp. 257–260, 3 refs. New Delhi, 1959.

The following is based on the authors' summary. In tests in India, sugarcane mosaic was experimentally transmitted by *Aphis maidis* Fitch to sugarcane of two varieties. The ability of the aphid to acquire the virus and transmit it varied with the cane variety, and the percentages of infection obtained were 27·2 and 55·3, respectively. It failed to transmit it to two other varieties, but their coarse hard leaves may have prevented feeding.

Abraham (E. V.). **Pests of cashew** (*Anacardium occidentale*) **in South India.**—*Indian J. agric. Sci.* **28** (1958) pt. 4 pp. 531–543, 4 figs., 11 refs. New Delhi, 1959.

Notes are given on the habits of some 40 species of insects that damage cashew (*Anacardium occidentale*) in southern India, together with general recommendations for control. The most important are *Plocaederus ferrugineus* (L.), a Cerambycid that bores in the stems and roots, and *Selenothrips rubrocinctus* (Giard), *Rhipiphorothrips cruentatus* Hood, *Acrocercops syngramma* Meyr., *Helopeltis antonii* Sign., *Cricula trifenestrata* (Helfer) and *Hypatima* (*Chelaria*) *haligramma* (Meyr.), which attack the leaves [*cf.* *R.A.E.*, A **49** 161].

Tirumala Rao (V.) & David (A. L.). **The biological control of Coccid pest in south India by the use of the beetle,** *Cryptolaemus montrouzieri* **Muls.**—*Indian J. agric. Sci.* **28** (1958) pt. 4 pp. 545–552, 6 figs., 4 refs. New Delhi, 1959.

The bionomics of *Cryptolaemus montrouzieri* Muls. and a method used to rear it in southern India are described, lists of Coccids on which it fed or did not feed are given, and several cases in which it controlled mealybugs after field liberation are recorded.

Das (G. M.). **Observations on the termites affecting tea in north-east India and their control.**—*Indian J. agric. Sci.* **28** (1958) pt. 4 pp. 553–560, 7 refs. New Delhi, 1959.

Tea bushes in north-eastern India are damaged by various scavenging termites, including *Odontotermes assamensis* Hlmgr., which builds mounds, and *O. parvidens* K. & N. Hlmgr. and other species of the genus, which nest in the soil, and by *Microcerotermes* sp., which nests in the soil and attacks the living wood. In tests, control of mound-building termites was achieved by introducing dusts of 5 per cent. DDT, BHC, aldrin or dieldrin into the top of the mound by a method that is described and watering them in. *Microcerotermes* was well controlled by spraying the soil with aldrin or dieldrin and forking it in; a rate of 2 lb. per acre afforded control for two years under favourable conditions.

Nagaraja Rao (K. R.) & Subramaniam (T. R.). *Glyphodes bivitralis* **Guen., as a new pest of jak.**—*Indian J. agric. Sci.* **28** (1958) pt. 4 pp. 561–562, 4 refs. New Delhi, 1959.

Margaronia (*Glyphodes*) *bivitralis* (Gn.), the larva, pupa and adults of both sexes of which are briefly described, was found feeding on the leaves of *Artocarpus integer* (*integrifolius*) in Madras State in February 1957. The larvae of this Pyralid are gregarious, remaining together and pupating within the folded and webbed leaves, and the larval and pupal stages last 14–16 and 8–10 days, respectively. Complete mortality of larvae was given by a spray of 1 lb. 50 per cent. wettable BHC in 6·5 gal. water, applied so as to penetrate the webbing.

Bhatia (V. V.), Dewan (R. S.), Kartha (A. R. S.) & Gulati (K. C.). **Terpenyl analogues of parathion (as insecticides). Terpene series (III).**—*Indian J. agric. Sci.* **28** (1958) pt. 4 pp. 569–574, 6 refs. New Delhi, 1959.

In investigations in India, three analogues of parathion, O,O-dilongifolyl-, O,O-dinopyl- and O,O-dibornyl O-p-nitrophenyl phosphorothioate, were prepared and found to have considerable toxicity to *Euproctis lunata* Wlk., *Corcyra cephalonica* (Stnt.) and *Tribolium castaneum* (Hbst.), though less than had parathion itself. The first was the best.

Malhotra (C. P.). **Bionomics of** *Serinetha augur* **Fabr. and its association with** *Dysdercus cingulatus* **Fabr., the red cotton bug.**—*Indian For.* **84** no. 11 pp. 669–671, 2 pls., 10 refs. Dehra Dun, 1958; also as *Bull. Indian Lac Res. Inst.* no. 94. Namkum, 1958.

Leptocoris (*Serinetha*) *augur* (F.) is a Coreid that is encountered together with *Dysdercus cingulatus* (F.) on cotton and *Schleichera oleosa*, a food-plant of the lac insect [*Laccifer lacca* (Kerr)], in India. Since little was known of its habits, it was reared in the laboratory in June 1953. Its life-history is described. Some cannibalism occurred, and both nymphs and adults attacked the seeds of *S. oleosa*, reducing their ability to germinate. *D. cingulatus* also fed on fruits of *S. oleosa*.

Delfinado (M. D.). **A survey of rice stem borer parasites in Rizal, Laguna and Pangasinan.**—*Philipp. Agric.* **42** no. 8–9 pp. 345–357, 11 refs. College, Laguna, 1959.

Rice in the Philippines is attacked by four species of stem borers, *Schoenobius incertulas* (Wlk.), *Chilo suppressalis* (Wlk.), *Sesamia inferens* (Wlk.) and *Scirpophaga innotata* (Wlk.). A survey of the parasites of the eggs, larvae and pupae of the first three was carried out, and a list of those reared is given, showing synonyms, the host and stage attacked, the characters of the adults and locality records. Five of the 17 had not previously been known in the Philippines. The parasites of the larvae seemed the most promising, and these, with their hosts following (in brackets), included *Bracon* (*Microbracon*) *chinensis* Szépl. (*Chilo* and *Sesamia*), *Glyptomorpha* (*Stenobracon*) *nicevillei* (Bingham) (*Sesamia* and *Schoenobius*), *Shirakia schoenobii* Vier. (*Schoenobius*), *Apanteles* sp. (*Schoenobius*), *Cremastus shirakii* Sonan (*Schoenobius*) and *Angitia* (*Horogenes*) *lineata* (Ishida) (*Schoenobius* and *Chilo*).

It is noted that *Trichogramma japonicum* Ashm. and *T. australicum* Gir., which parasitise the eggs of *C. suppressalis*, were introduced from Japan and Formosa in July 1954, reared in the laboratory and released in Luzon and Palawan. No recovery has been reported.

Viado (G. B.) & Matthysse (J. G.). **A field test on the use of insecticides and cover-cropping and their bearing on the control of abacá mosaic.**—*Philipp. Agric.* **42** no. 8–9 pp. 364–373, 1 fig., 6 refs. College, Laguna, 1959.

Abacá mosaic is a destructive virus disease of abacá [*Musa textilis*] in the Philippines and is transmitted by *Aphis maidis* Fitch and *A. gossypii* Glov. [*cf. R.A.E.*, A **39** 64]. Experiments on its control by the use of insecticides and cover-cropping are described; the results have already been noticed [**46** 354].

Viado (G. B.) & Labadan (R. M.). **"Inert" dusts for the control of storage insects of shelled corn.**—*Philipp. Agric.* **42** no. 10 pp. 414–422, 17 refs. College, Laguna, 1959.

The following is based on the authors' summary of this account of investigations in the Philippines. Of three inert dusts tested at rates of 0·5 and 1 per cent. for the control of insects attacking shelled maize, Maquiling clay (white earth) was the most effective, followed by rice hull ash and sugar-cane bagasse ash. The superiority of the clay was apparently due to its fineness and high sticking quality. *Sitophilus oryzae* (L.) and *Rhyzopertha dominica* (F.) were the most numerous and destructive of the nine species of insects found in the sacks.

Cumber (R. A.) & Todd (D. H.). **Serious outbreak of the aphid *Rhopalosiphum padi* (L.) in North Island wheat, oat, and barley crops during 1958.**—*N.Z. J. agric. Res.* **2** no. 4 pp. 773–784, 6 figs., 4 refs. Wellington, N.Z., 1959.

An outbreak of *Rhopalosiphum padi* (L.) on wheat, oat and barley reached serious levels, for the first time in New Zealand, in three districts in the North Island in the early summer of 1958. Abnormally dry, warm conditions are regarded as being primarily responsible. Surveys in these districts and

one other between 11th and 15th November showed that the heaviest damage was on northerly slopes in rolling country. Faint yellowing and general unthriftiness was first noticed on wheat about 1 ft. high at the end of October, and severe yellowing and stunting occurred within a week over considerable areas. Heavy populations were found at or slightly below ground level on the succulent leaf sheaths of wheat, oats and barley 6–9 in. high that showed yellowing and stunting, though apparently uninfested. Alates evidently migrate from grassland to all parts of the crop soon after it is established; populations build up at ground level for about 4–6 weeks and move up the plants when the basal growth is destroyed. Most damage probably occurs when the plants are 6–12 in. high. Natural enemies, of which *Coccinella undecimpunctata* L. and *Syrphus novae-zealandiae* Macq. were common, increased considerably in advanced infestations, but, although they exerted considerable control, they apparently cannot check the population during crop establishment.

A spray of 0·75 pint methyl-demeton (Metasystox) in 10 gal. water per acre applied by aeroplane to severely damaged wheat on 16–17th November, to wheat with moderate basal infestation on 19th November and to infested barley on 17th November gave inconclusive results, since populations on both treated and untreated crops declined, but the barley was free from infestation on 3rd December, when populations on untreated plants were still moderately high. A wheat crop that was yellowing in patches was sprayed with 3 pints DDT in 10 gal. water per acre in the first week of November and was free from infestation on 12th November, but this may not be attributable to the spray.

Todd (D. H.). **The apple leaf-curling midge, *Dasyneura mali* Kieffer, seasonal history, varietal susceptibility and parasitism 1955–58.**—*N.Z. J. agric. Res.* **2** no. 5 pp. 859–869, 3 refs. Wellington, N.Z., 1959.

The following is based largely on the author's summary. An account is given of seasonal studies on *Dasyneura mali* (Kieff.) in apple orchards at a place in New Zealand where numbers of this Cecidomyiid reached significant proportions in the seasons of 1955–56 and 1956–57, but were lower in 1957–58. There were normally five generations a year [*cf. R.A.E.*, A **45** 453], of which the second and third were the most injurious. The first generation affected only apple varieties that produce early leaves, and the last two were small owing to the reduction in food-supply caused by previous defoliation and the lack of terminal growth at the end of the growing season. From dissections of larvae made each season when they were almost fully fed, it was found that the introduced parasite, *Prosactogaster demades* (Wlk.) [*loc. cit.*], generally reached a high level of attack in all generations except the second, in which parasitism did not exceed 2·8 per cent. Its failure to check the second generation limits its usefulness as a control agent, and the application of insecticides at this period would supplement its action. Studies in 1956–57 showed that none of 12 commonly grown apple varieties is immune from attack by *D. mali*, and that the degree of susceptibility and infestation is determined by the quantity of terminal growth present. No marked varietal preference was detected.

Todd (D. H.). **Black beetle *Heteronychus sanctae-helenae* Blanch., in pastures in New Zealand.**—*N.Z. J. agric. Res.* **2** no. 6 pp. 1262–1273, 6 figs., 8 refs. Wellington, N.Z., 1959.

Heteronychus sanctae-helenae Blanch., all stages of which are briefly described and which was first observed in New Zealand in 1937 [*R.A.E.*, A **33**

93], has become an important pest of pastures in the North Island, where it is confined mainly to coastal areas round Auckland and to the north of Gisborne. Studies on its bionomics and control carried out during 1957–58 showed that it has one generation a year. The winter is passed mainly in the adult stage, though some late larvae and pupae also overwinter. Mating takes place in the soil in spring, and eggs are present mainly from mid-October until early January. Early in the season, the larvae hatch in six weeks; they pass through three instars, and the adults to which they give rise emerge in February–May, feed from March to June, remain dormant from June to September, and feed again from September to December, after which they die. The larvae feed mainly between December and February or, occasionally, March. Populations are usually greatest in pastures on light, friable, sandy soils or in peat soils. Most pasture grasses are susceptible, and numerous other plants are also attacked. The adults feed mainly on the roots, but damage to the crown was observed in cocksfoot [*Dactylis*]. In a pot experiment in which common pasture grasses were exposed to larval attack, rye-grass [*Lolium perenne*] was gnawed through just below ground level and was dead in five weeks; *Paspalum* and cocksfoot were less severely injured, but damage to the roots caused significant loss in vigour. A few of a number of first-instar larvae provided only with soil developed to the pupal stage. The adults, but not the larvae, tolerate submersion in water for long periods, and many larvae are drowned in areas subject to flooding, which leads to irregular population distribution. A milky disease causes substantial mortality among overwintering larvae and pupae [*cf.* **46** 158, 191], especially in persistently wet soils, but attempts to isolate bacterial spores from apparently diseased larvae were unsuccessful.

In a small-scale experiment on control in January 1958, dieldrin and aldrin applied to soil in pots gave complete mortality of first- and second-instar larvae in a month and 81–86 per cent. mortality of third-instar larvae in three weeks and were superior to γ BHC (lindane) and DDT. In a field trial with dieldrin applied in December 1958 to a pasture in which *Paspalum* was dominant and the population of *Heteronychus* (mainly eggs and adults of the previous season) averaged 12 per sq. ft., a proprietary wet mixture of dieldrin and superphosphate at 8 oz. toxicant per acre and dry mixtures of dieldrin with superphosphate applied at 4, 8 and 16 oz. toxicant per acre all gave significant control after 58 days. The dry mixtures were significantly superior to the wet, and the highest application rate was significantly superior to the other two.

Harrow (K. M.). **Toxicity of some arsenical wood-preservatives to the common house borer,** *Anobium punctatum* **De Geer.**—*N.Z. J. Sci.* **2** no. 2 pp. 208–211, 2 refs. Wellington, N.Z., 1959.

The following is based largely on the author's summary. Tests in New Zealand, in which blocks of air-dried sapwood of *Podocarpus dacrydioides* were impregnated with arsenic pentoxide, Boliden S 25 (a proprietary preparation stated to contain 48·3 per cent. arsenic pentoxide, 15·5 per cent. zinc oxide, 5·2 per cent. cupric oxide and 31 per cent. chromium trioxide), Tanalith C (42·6 per cent. potassium dichromate, 36·9 per cent. hydrated copper sulphate and 20·5 per cent. hydrated arsenic pentoxide) or Tanalith U (23·5 per cent. disodium hydrogen arsenate, 39 per cent. sodium chromate, 25·3 per cent. sodium fluoride and 12·2 per cent. dinitrophenol) [*cf. R.A.E.*, A **38** 261] and exposed to adults of *Anobium punctatum* (Deg.) for eight months, showed that the toxicity of these wood preservatives to the larvae is proportional to their arsenic content. The toxicity of arsenic in the preservatives was equal to that of arsenic introduced into the wood as arsenic

pentoxide, from which it is concluded that the other components neither contributed to toxicity nor reduced the availability of the arsenic in the wood. Larvae survived at retentions of 0·01 per cent. arsenic pentoxide on an oven-dry basis, but retentions of 0·018 per cent. prevented their development.

Morris (D. S.) & van Baer (R.). **DDT-resistant codling moth in Victoria. Laboratory and field investigations with insecticides.**—*J. Agric. Dep. Agric. Vict.* **57** pt. 10 pp. 619–623, 684–687, 4 figs., 9 refs. Melbourne, 1959.

DDT gave excellent control of *Cydia pomonella* (L.) on apple in Victoria until the season of 1956–57, when resistance to it was observed in several localities, notably in the Goulburn Valley. Tests of alternative insecticides were carried out in 1957–59. In 1957–58, nine fortnightly applications of emulsion sprays containing 0·06 per cent. malathion, 0·025 per cent. parathion, 0·02 per cent. diazinon or 0·075 per cent. trichlorphon (Dipterex), five applications of 0·03 per cent. wettable Trithion, or three applications of 3 lb. lead arsenate per 100 gal. followed by six of the malathion spray all gave excellent control and were significantly superior to five applications of 0·1 per cent. DDT or no treatment. Infestation on the DDT-treated plot was relatively low (10·5 per cent.), but adults reared from infested fruits were shown to be resistant to topical applications of DDT; further laboratory tests indicated that DDT deposits did not repel ovipositing females and that 0·1 per cent. DDT still gave significant protection against first-instar larvae. The drop in infestation from 100 per cent. in 1956–57 to 10·5 per cent. in 1957–58 is attributed in part to the reduction in population caused by the use of organic phosphorus sprays late in the season and in part to the substitution of hand for power spraying equipment. An emulsion spray of 0·05 per cent. azinphos-methyl (Gusathion), applied nine times at fortnightly intervals to an adjacent plot, reduced damage to less than 1 per cent. All the phosphorus sprays, and particularly azinphos-methyl, caused some damage to the fruit.

In 1958–59, the effect of increasing the intervals between sprays to three weeks was investigated. At one place, where sprays of 0·05 per cent. wettable ethion and 0·1 per cent. wettable Sevin were included, in addition to those of the organic chemicals previously tested, azinphos-methyl and Sevin were the most effective. Very thorough coverage was obtained, and both reduced damage by *C. pomonella* from 31·8 to 0·2 per cent.; they also reduced damage by *Austrotortrix postvittana* (Wlk.) from 39·1 to 0·4 and 0·2 per cent., respectively. None of the sprays damaged the fruit, but all wettable formulations left visible residues at harvest. At another place, where *C. pomonella* was shown to be still very susceptible to DDT, the same nine sprays were tested and also emulsion sprays containing 0·05 per cent. AC 528 (2,3-p-dioxane S,S-bis(O,O-diethyl phosphorodithoate)) or azinphos-methyl or 0·02 per cent. malathion or ethyl-DDD (Perthane), lead arsenate at 3 lb. per 100 gal., and a schedule of malathion followed by dicapthon, both at 0·05 per cent. Sevin, azinphos-methyl (both formulations), AC 528 and DDT gave the best protection from *C. pomonella* (not more than 0·1 per cent. damage). The percentage damage by *A. postvittana* amounted to 17·5 in unsprayed plots and, among sprayed plots, was highest (2·8) on trees sprayed with ethion. In both trials, fruits treated with azinphos-methyl in the emulsion spray showed damage after storage for four months. In laboratory tests, wettable azinphos-methyl or Sevin gave almost complete control of newly hatched larvae for 16 days, but Trithion gave only moderate control and in the field is evidently effective mainly against the adults.

Emulsion sprays of azinphos-methyl and parathion caused over 95 per cent. and diazinon 74 per cent. mortality of eggs from a resistant stock.

On the basis of these results, a schedule of 0·05 per cent. wettable azinphos-methyl or 0·1 per cent. wettable Sevin at three-weekly intervals, beginning not later than the last week of October in the Goulburn Valley and the first week in November elsewhere and ending not later than the end of December, is recommended where resistant populations of *C. pomonella* are present.

Button (J. A.) & Koch (L. E.). **Potato moth control.**—*J. Dep. Agric. W. Aust.* (3) **8** no. 6 pp. 653–656, 3 figs., 1 ref. Perth, W.A., 1959.

Following reports of disappointing control of *Gnorimoschema operculella* (Zell.) on potato in Western Australia by DDT in recent years, the effectiveness of this material was compared with that of three other insecticides. The spray materials were a concentrate of trichlorphon (Dipterex) and emulsion concentrates containing 20 per cent. endrin, 25 per cent. dieldrin or 20 per cent. DDT, and they were applied at 1, 1, 1½ and 2 pints, respectively, in 50 gal. water per acre. Infestation was unusually heavy, and four applications were made at nine-day intervals. Damage assessments on leaf samples showed that DDT, dieldrin and endrin gave good control, and trichlorphon some measure of protection. Three weeks after the last application, damage had increased in all plots by about the same amount. Yields of tubers from treated plants were higher than those from untreated ones, and plants treated with trichlorphon gave significantly lower yields than the other treated ones. It is concluded that *Gnorimoschema* has not developed resistance to DDT and that two or possibly three thorough applications should suffice to protect summer crops.

Cohic (F.). **Enquête sur les parasites animaux d'intérêt agricole à Wallis.** —[1 +] 69 pp., 2 pls., 1 map, 18 refs., multigraph. Nouméa, Inst. franç. Océanie, 1959.

This work is based on a visit to the Wallis Islands in early 1959 and consists essentially of a list of the crops and other useful plants showing the insects that attack them, with notes on their habits, importance and sometimes control. *Oryctes rhinoceros* (L.), the most important pest of coconut, is dealt with at some length, and it is noted that the appearance of *Aspidiotus destructor* Sign. on this crop, which was free from it in 1950 [*cf. R.A.E.*, A **42** 214], has created a further problem. This Coccid, which was probably introduced by air from Fiji, has already caused severe damage; it is parasitised by *Aspidiotiphagus citrinus* (Craw), which probably arrived with it.

Host list of insects recorded in the South East Asia and Pacific Region. *Theobroma cacao*—**Cacao.**—*Tech. Docum. FAO Plant Prot. Comm. S.E. Asia* no. 11 [pt. 2], 8 pp., multigraph. Bangkok, 1961.

This is a systematic list of insects taken on cacao in the region concerned, showing the part of the plant affected and the country. Pests of the stored beans are included.

Wallis (R. C.). **Factors affecting larval migration of the gypsy moth.**—*Ent. News* **70** no. 9 pp. 235–240, 3 refs. Lancaster, Pa., 1959.

The following is virtually the author's summary. Laboratory tests were conducted in which the manipulation of plastic cylinders was used to determine the effect of food, moisture, light and geotropism on the migratory activity of larvae of *Lymantria* (*Porthetria*) *dispar* (L.). Food was encountered primarily in the process of migration stimulated by these factors, and the larvae exhibited no indication of being attracted by it alone. Likewise, no attraction or tendency of the larvae to migrate toward moisture could be observed except, as in the case with food, when the larvae were responding to the influence of other factors. Early-instar larvae exhibited the strong phototropic response described by Forbush & Fernald and the negative geotropic reaction reported by de Lepiney. However, in both field and laboratory tests, the migratory movements of late-instar larvae appeared quite different from those of young larvae. For this reason, it is necessary to consider larval age and the influence of interacting factors when larval migratory activity is under study.

Way (M. J.). **The effect of temperature, particularly during diapause, on the development of the egg of** *Leptohylemyia coarctata* **Fallén (Diptera: Muscidae).**—*Trans. R. ent. Soc. Lond.* **111** pt. 12 pp. 351–364, 7 graphs, 22 refs. London, 1959.

The following is substantially the author's summary. In Britain, the eggs of *Hylemyia* (*Leptohylemyia*) *coarctata* (Fall.) are usually laid on bare soil in August and hatch during the following January–March [*cf. R.A.E.*, A **34** 367]. The embryo apparently becomes fully developed before the diapause, and pre-diapause morphological development merges imperceptibly into the diapause stage. Investigations showed that the diapause ends by January, and the eggs begin to hatch shortly afterwards, when the temperature is above 0°C. [32°F.]. Although eggs near the surface experience much greater temperature fluctuations than those deeper in the soil, all hatched at the same time. Within the normal temperature range, the lower and upper limits for pre-diapause morphological development, diapause physiological development and post-diapause development (reactivation and hatching) were between 0–3°C. and over 30°C. [between 32–37·4°F. and over 86°F.], −6 and 12°C. [21·2 and 53·6°F.], and 0 and over 30°C., respectively. The optimum constant temperature for diapause development was about 3°C. The egg developed through all stages at constant temperatures between 3 and 12°C.; the optimum was about 7°C. [44·6°F.]. Development was accelerated in some eggs by transferring them in the middle of their diapause to 30 or 35°C. [86 or 95°F.] for 1–7 days, but it was stopped or reversed by an interval of 2–4 weeks at 20°C. [68°F.]. Development could proceed at the beginning of diapause, and to a lesser extent towards the end, at a temperature above the upper limit for the intervening stages. This suggests that the temperature optimum for diapause may vary as development proceeds. Diapause development at −20°C. [−4°F.] may be as rapid as at 3°C. This is not ecologically significant, but may help towards an understanding of the physiology of diapause.

Ashworth (R. de B.). **Collaborative Pesticides Analytical Committee of Europe.**—*FAO Plant Prot. Bull.* **9** no. 2 pp. 17–18. Rome, 1960.

Recommended analytical methods for pesticides. I. Mercury in formulated or technical products.—*T.c.* pp. 19–28, 3 figs., 2 refs.

The Collaborative Pesticides Analytical Committee (CPAC), described in the first paper, was set up in 1957 to prepare agreed analytical methods for

materials and their formulations used in crop protection as insecticides, fungicides, herbicides, rodenticides, attractants and repellents, the methods to include those necessary for the determination of the chemical composition and the physical properties of the materials and their formulations. Representatives of at least seven European countries are at present participating in the work. About 20 methods have so far been accepted, and others are in draft form. They are to be published from time to time in the *FAO Plant Protection Bulletin*.

In the second paper, three basic methods for the analysis of mercury in formulated or technical products, some of them including insecticides, are described.

Papers noticed by Title only.

Cushman (H. G.). **Index XVII to the literature of American economic entomology January 1, 1958–December 31, 1958.**—*Spec. Publ. ent. Soc. Amer.* no. 17, x+501 pp. College Park, Md., 1960. [*Cf. R.A.E.*, A **48** 196.]

Boulanger (L. W.). **The effect of European red mite** [*Panonychus ulmi* (Koch)] **feeding injury on certain metabolic activities of Red Delicious apple leaves.**—*Bull. Me agric. Exp. Sta.* no. 570, 34 pp., 12 graphs, 20 refs. Orono, Me., 1958.

Hawkins (J. H.), McDaniel (I. N.) & Murphy (E.). **Wireworms affecting the agricultural crops of Maine.**—*Bull. Me agric. Exp. Sta.* no. 578, 40 pp., 24 figs., 15 refs. [Orono, Me.] 1958.

Ponomarenko (A. V.). **Insects damaging oak plantations in the eastern districts of the Rostov region.** [*In Russian.*]—*Zool. Zh.* **37** pt. 11 pp. 1645–1658, 15 refs. Moscow, 1958. (With a summary in English.)

Shutyaev (A. M.). **Data on the bionomics and ecology of** *Melolontha melolontha* **L. under the conditions of the Central Chernozem State Game Preserve.** [*In Russian.*]—*Zool. Zh.* **37** pt. 11 pp. 1659–1667, 1 map, 19 refs. Moscow, 1958. (With a summary in English.)

Moravskaya (A. S.). *Elegia* (*Salebria*) *atrifasciella* **Rag., a pest of oaks** [in the Stalingrad district]. [*In Russian.*]—*Zool. Zh.* **37** pt. 11 pp. 1674–1681, 2 figs., 3 refs. Moscow, 1958. (With a summary in English.)

Zagulyaev (A. K.) & Liao (Din-si). **A new genus and species of predacious moth,** *Laccifcrophaga yunnanca* **Zagulajev, gen. et sp. n. (Lepidoptera, Momphidae) attacking the lac insect** [*Laccifer lacca* (Kerr)] **in southern China.** [*In Chinese & Russian.*]—*Acta ent. sin.* **9** no. 4 pp. 306–315, 5 figs. [Peking] 1959.

Vago (C.). **Sur le mode d'infection de la virose intestinale de** *Thaumetopoea pityocampa* **Schiff.**—*Entomophaga* **4** no. 4 pp. 311–314, 3 figs., 9 refs. Paris, 1959. (With a summary in German.)

Bonnefoi (A.) & Grison (P.). **État actuel et perspectives de la lutte par voie microbiologique contre les insectes nuisibles aux cultures** [a review article].—*Phytiat.-Phytopharm.* **8** no. 2 pp. 65–72, 2 pls., 18 refs. Paris, 1959.

Bates (A. N.). **Analysis of endrin residues in flour by infra-red spectroscopy.**—*J. Sci. Fd Agric.* **11** no. 12 pp. 750–754, 6 refs. London, 1960.

NOTICES

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